STATE OF ILLINOIS
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DEPARTMENT OF REGISTRATION AND EDUCATION
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DIVISION OF THE
STATE GEOLOGICAL SURVEY
M. M. LEIGHTON, *Chief*
URBANA

REPORT OF INVESTIGATIONS—No. 93

PROGRESS REPORTS ON

SUBSURFACE STUDIES OF THE PENNSYLVANIAN SYSTEM IN THE ILLINOIS BASIN

PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

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Topographic Mapping in Cooperation with the United States Geological Survey.
This report is a Contribution of the Coal Division.

April 10, 1944

CONTENTS

ILLUSTRATIONS

PROGRESS REPORTS ON

SUBSURFACE STUDIES OF THE PENNSYLVANIAN SYSTEM IN THE ILLINOIS BASIN

INTRODUCTION

BY

M. M. LEIGHTON, *Chief*

THE FOLLOWING papers, which are presented on the basis of information acquired up to May 31, 1943, are the first of a series on the subsurface geology of the Pennsylvanian system in the Illinois basin. The first paper presents the general procedure and technique of well-logging as practiced by the Survey field parties, describes the methods used in measuring the thickness of strata including coal beds, and discusses the use made of time logs and stratigraphic logs in interpreting the electric logs of nearby wells.

The second paper deals with the stratigraphy and structure of the Millersville limestone. The relatively thick limestone, which lies about 600 feet above the Herrin (No. 6) coal bed, is believed to be a key to the position of that coal seam and to the general structural features of the Pennsylvanian system in the northern part of the Illinois basin.

The third paper describes the Pennsylvanian key beds of Wayne County and the structure of one of the limestone beds of the McLeansboro group—herein tentatively called the "Shoal Creek" limestone—and the Herrin (No. 6) coal bed.

The fourth paper summarizes the data on the workable coal beds discovered in the first 140 wells logged. Most of these coals include beds down to Harrisburg (No. 5) coal bed and some that lie below coal No. 5.

This work on the Pennsylvanian system lying within the Illinois basin had long been contemplated as a means of providing part of the information needed in the study of the oil and gas, coal, and other resources of that area, but until the supplementary appropriations of the Sixty-second General Assembly, first Special Session, were made in January 1942, it was seldom possible to supply personnel from the Survey staff to observe oil drilling operations, collect samples, and interpret them, so that until then less than ten wells had been so recorded. When the additional appropriations became available, the work was assigned to the Coal Division because of its familiarity with the stratigraphic problems of the Pennsylvanian system and its related responsibility of furnishing to the Department of Mines and Minerals the information needed for properly sealing off the coal beds penetrated by oil and gas wells and holes drilled for other purposes.

It was desirable, during the early months of this investigation, to obtain critical information at as many places as possible. The character of the stratigraphic succession down to the Herrin (No. 6) coal bed and the position of this coal bed seemed to be information essential to the understanding of the Pennsylvanian succession as a whole in the Illinois basin. Accordingly during the first year of the investigation most of the observations extended only to the Herrin (No. 6) or to the Harrisburg (No. 5) coal bed, the latter usually lying within about 100 feet below the No. 6 bed. Only a few holes were logged entirely through the Pennsylvanian succession during this time. It was expected, once the general character of the upper part of the Pennsylvanian succession had been explored, to extend observations into the lower part of the system.

Obviously the benefits of the work are manifold: Knowledge of the stratigraphy, structure, and resources of the Pennsylvanian system becomes available to all; information concerning the position and relationships of key beds such as limestones, black "slates," and coal seams is beneficial to those interested in structural information to guide exploration for oil and gas; the positions of workable coal beds can be determined so that they can be protected during drilling and sealed off when abandoned wells and dry holes are plugged; and coal and other resources can be evaluated.

As the study of the subsurface geology of the Pennsylvanian system progresses, reports and maps will be prepared for other areas in the Illinois basin.

The planning and execution of the work has been under the direction of G. H. Cady, Senior Geologist and Head of the Coal Division, and during the present period the following geologists were assigned to the compilation of drilling-time logs: E. F. Taylor, M. W. Pullen, Jr., P. K. Sims, A. L. Browkaw, A. F. Agnew, Robert Kelley, Robert Smith, Robert Reynolds, H. L. Smith, and Maxwell Caplan. Other geologists of the Division who have assisted in the field were: J. N. Payne, J. M. Schopf, D. F. Kent, R. M. Kosanke, and A. L. Eddings. In addition the following persons have assisted in the office in studying drill-cuttings, compiling logs, and preparing instructions to accompany drilling permits: Kenneth Clegg, Bernice Lamb, Margaret Parker, Virginia Kremers, Robert Simon, Dorothy O'Donnell, and Kenneth Gutschick.

Prior to the start of the present logging program, Dr. J. V. Howell of the Adkins Oil Company, Benton, Illinois, a geologist of long experience, contributed stimulating suggestions relative to the value and procedure of time logging. Members of the other oil companies and drilling crews have also given whole hearted and generous cooperation during the study of their wells, without which it would have been impossible to conduct the investigations.

METHODS OF SUBSURFACE STUDY OF THE PENNSYLVANIAN STRATA ENCOUNTERED IN ROTARY-DRILL HOLES

BY

EARLE F. TAYLOR, M. WILLIAM PULLEN, JR., PAUL K. SIMS, AND J. NORMAN PAYNE

IN ORDER to obtain for the public files the information necessary for an understanding of the geology and economic resources of the Pennsylvanian system in the Illinois basin, carefully prepared records of the strata penetrated by drilling must be compiled. Drillers' logs lack much information that is essential in interpreting Pennsylvanian stratigraphy. This is not surprising when we take into account the rapidly alternating character of the strata and the thinness of many of the lithologic units which serve as index beds.

Experience has shown that certain thin limestones, some not more than 5 to 10 feet thick, have value as index beds. Likewise coal beds and their associated strata of black "slates" and underclays, together with other beds, have their importance as stratigraphic markers.

Economically, coal beds 30 inches thick at depths of less than 1,000 feet, and 36 inches thick at depths of more than 1,000 feet, are regarded as of workable thickness. Soft beds of this small thickness at these and even lesser depths are very easily overlooked in rotary drilling. And coal beds too thin to be workable are nevertheless useful in stratigraphic determinations.

Electric logs are valuable supplements to driller's logs in interpreting the succession of strata and in identifying certain key beds, but their utility is greatly increased by sample cuttings collected at close intervals and by time-logs.

The technique to be described is probably not greatly different from that employed by many oil geologists working in the Illinois basin, except that in some cases they can, if they wish, obtain greater precision by controlling the drilling operations.

In general it may be said that the accurate recording of the strata of the Pennsylvanian system and the recognition of index beds of whatever nature, be they limestones, black "slates," coals, underclays without coals, or associations of these, is best accomplished by observing and recording drilling time, by collecting at close intervals and studying drill-cuttings, by use of an electron tube-sound amplifying device, and by use of electric logs. The drilling-time log, the log compiled from cuttings, and the electric log have been used concurrently—when all three kinds of data were available—for many wells in order to obtain a complete picture of the succession (see fig. 2). For a few wells the data obtained from the sound amplifying device have been available, and for some wells only the drilling-time log and the log compiled from cuttings could be used.

I. FIELD METHODS

A. RECORDING OF DRILLING TIME[1]

The stop-watch.—For compiling an acceptable drilling-time record a stop-watch with a sweep-second hand has been found essential. If one- or two-foot intervals are to be accurately recorded, the observer must be able to make readings in seconds.

Drilling-time form.—Drilling time is recorded on a special form (fig. 1) with columns for depth, minutes, remarks (connections, trips, etc.), and notes on the formations drilled.

Marking the kelly.—Drilling-time observation requires marking the kelly at one- or two-foot intervals. If possible this is done

1 Hiestand, T. C., and Nichols, P. B., Drilling time in rotary practice: Bull. Am. Assoc. Petroleum Geologists, vol. 23, No. 12, pp. 1820-34, Dec. 1939.

STATE GEOLOGICAL SURVEY, URBANA, ILLINOIS

DRILLING-TIME LOG OF WELL

Company_____ Farm_____ No._____

Elev._____ Contractor_____ Sec._____ T._____ N., S., R._____ E., W. Co._____

DEPTH	TIME	MINUTES	LOG, REMARKS, STOP	DEPTH	TIME	MINUTES	LOG, REMARKS, STOP

FIG. 1.—Heading of drilling-time log form used by the Illinois State Geological Survey.

before drilling starts, while the kelly is dry. Marks made with a white or yellow quick-drying paint or enamel remain clearly visible for several hours and can at least be used as guides to re-mark the kelly after each connection. A double mark at the five-foot positions assists observation. The drilling-time depths are constantly checked against the pipe tally, and necessary adjustments are made. The depth at each joint is recorded on the drilling-time log. Thus accumulation of errors with increasing depth is avoided. This procedure also checks the pipe tally.

Time measurement.—The time in minutes and seconds required for the kelly to drop one selected unit of depth (1 foot, 2 feet, 5 feet, etc.) below the rotary table is entered on the record sheet. It is convenient to have several record sheets filled out in advance with the successive units of depth so that the only entry required at the time of observation is the actual drilling time. When the interval is as small as one foot, the rate of drilling and the position of the sampling box may make it impossible for one person to observe drilling time and also to sample the cuttings.

Incidental observations.—Drilling time, in the last analysis, is only an index of lithological variations based upon the comparative rates of drilling of different kinds of rock. Actual rates of drilling of similar strata depend upon conditions of mechanical operation, such as the speed of the rotary table, the type and sharpness of the bit, the weight on the bit, the pump pressure, and the volume, weight, and viscosity of the drilling fluid. The rate of drilling may become slower or faster as the bit is worn, depending upon the lithology and the type of bit. Comparison of drilling time at different depths must take these variables into consideration, hence a careful record is kept of mechanical operations and changes.

B. COLLECTION OF DRILL-CUTTINGS

Sampling interval.—The collection of drill-cuttings by the Survey field party is made without interfering with the normal drilling operation or the collection of cuttings by the drilling crew, but is made at smaller intervals than the 10-foot interval widely adopted as standard for the collection of cuttings. This 10-foot interval is too great to permit the accurate determination of the thickness and the position of the many thin but stratigraphically important members of the Pennsylvanian system. In general, therefore, for the purposes of the present investigation, cuttings are collected at intervals of 5 feet or less.

When cuttings are collected at close intervals and the Pennsylvanian succession compiled from a well kept time-log, an excellent record results, many of the details of which can usually be substantiated by an electric log. Short of a campaign of core-drilling, the best technique for studying Pennsylvanian stratigraphy and structure as well as the coal resources in the Illinois basin is the careful logging of rotary-drill holes through at least the upper 1000 to 1500 feet of Pennsylvanian beds.

Field technique.—Because in most operations automatic sampling equipment is not installed, the Survey field parties observe a technique in the collection of drill-cuttings from rotary-drill operations somewhat as follows:

(1) The sample box and trough is cleaned of cuttings so far as possible after each sample is collected. The mixture of two or more "runs" of cuttings and also the possible loss of light materials such as coal, because of overflow of cuttings are thereby avoided.

(2) In the upper 1000 to 1200 feet of drilling, cuttings are usually collected, as has been stated, at intervals of not more

than 5 feet. When it is desirable to obtain more particular information about strata for the upper 100 to 300 feet, cuttings have been collected to these depths at intervals as small as 1 foot. The value of close sampling has been found to decrease with increased depth of the hole, owing to the lag in delivery of the cuttings at the surface and their mixture with materials from different levels. The depth to which a small sampling interval can be effectively continued is a matter which must be decided by the field observer.

(3) As the drilling crew generally collects samples at 10-foot intervals and the Survey representatives collect them at intervals of less than 10 feet, some arrangement is necessary whereby a complete sample of the 10-foot interval can be obtained although the sample box is cleaned out every 1, 2, or 5 feet as the case may be. This is accomplished by providing a convenient receptacle into which a duplicate sample for each short sampling interval can be dumped. At the 10-foot interval the driller's helper obtains a sample from the receptacle into which the increments have been dumped, presumably after the material has been well mixed.

(4) The sample sacks used by the Survey are of the conventional type with a cloth tag sewed into the side or end. Upon the tag is entered the depth interval penetrated by the bit since the last sample was taken. No attempt is made to indicate the depth from which the cuttings actually come except in the case of coal samples, as explained under (7).

(5) Whenever there are rapid changes in the drilling time, samples are collected with special care in order to isolate cuttings representing each of the individual beds that produce the variations in the drilling speed. On the other hand, when drilling is uniform for many feet and field inspection shows that cuttings are similar, the collections from several units of drilling time might well be combined into a single sample. This procedure, however, has been followed with caution lest important variations not revealed by difference in hardness might be overlooked; actually it is rarely adopted.

(6) Concurrently with the drilling time, other information is recorded that will assist later in correlating the drilling-time log with the cuttings collected at any particular depth of the hole. Lag is one such item of information. There is always some lag between the time the bit enters a stratum and the time that cuttings from the stratum appear in the sample box. The difference between the time the bit enters the stratum as shown by the drilling-time log and the time of appearance of the cuttings in the return is the lag. The amount of lag is recorded on the time log. When drilling is slow, the cuttings may appear in the box before a particular hard stratum has been completely penetrated. On the other hand, if the drilling is fast and through a succession of relatively thin variable beds, the cuttings appearing at any time in the sample box will probably represent some stratum above that one in which the bit is drilling at the time the cuttings are collected. Lag increases with the depth of the well and is affected by the volume and condition of the drilling fluid and the character of the cuttings themselves.

(7) Special care is employed in the determination of coal-bed depths and thicknesses. Since coal beds are commonly overlain by a caprock of limestone, the drilling observer should be prepared for a period of fast drilling as soon as any limestone bed is penetrated. Associated with each coal bed in the Illinois basin there is usually an overlying black shale or "slate" and an underclay. Both are commonly 2 to 3 feet thick but each may be twice or three times as thick. Although the black "slate" in some holes is distinctly harder than the coal bed, the difference is not always so distinct, so there may be several feet of strata, only partly represented by a coal bed, which drill relatively very fast. Nevertheless, thicknesses of each of the softer components—black shale, coal, and underclay—can be closely approximated from the drilling time. To substantiate the thickness determinations a continuous-flow sample of the cuttings is taken from the ditch or trough with a sieve, thus determining the amount and kind of material drilled at the designated depths. The estimates are eventually checked with electric logs when possible. Caliper-logging appears to indicate correctly the position of underclays and roughly the position of the base of the coal beds. Unfortunately caliper surveys of drill-holes are not common in the Pennsylvanian beds of Illinois.

Shale separators or shakers and automatic sampling devices simplify somewhat the various operations noted above, but care must still be taken in observing the time lag and in estimating thickness of beds on the basis of the time during which particular cuttings dominate the sample delivery.

C. Drilling-Sound Logging

Equipment.—Identification of lithologic units of the Pennsylvanian system by means of electron tube amplification of the sound produced in drilling the rock strata has been experimentally investigated by the Survey. The investigation was exploratory only, for the purpose of determining whether the differences in the sound made by the rotary bit in penetrating different kinds of rock can, when subjected to electron tube amplification, be identified by the human ear. The tests convincingly demonstrated that this is a real possibility. Definite agreement was discovered between the audible sound record and the drilling-time record. Changes in the character of the strata indicated by changes in the rate of drilling and in the cuttings were identified by different individuals who used the sound equipment. Whenever arrangements at a drilling rig permit its use, the device aids in determining the position where changes in the character of beds occur, or perhaps even in the actual identifications of coal beds because of their peculiar physical properties.

The apparatus used in sound logging consists of a contact microphone, a radio-amplifier unit, and a pair of headphones. The contact microphone was chosen because of its great sensitivity to sound vibrations transmitted through solid materials and because of its non-sensitivity to sound waves in the air. A radio-amplifier unit was used with an orthodox circuit having three stages of audio amplification, the output of which goes to the headphones. The apparatus with its power supply of "A" and "B" batteries is housed in a portable case. When some of the recently perfected sound-recording devices are released for civilian use, they may be very useful in this field.

The grinding sound heard through the headphones is presumably caused mostly by the action of the bit at the bottom of the hole. Distinguishable changes in sound (pitch, tone, etc.) are brought about by changes in the speed of the bit or changes in the lithology of the rock, or both, inasmuch as a lithologic change usually produces some change in the speed of the bit. The sound of the bit-action is transmitted upward through the drilling fluid or drill-pipe to the surface casing, which serves as a sounding board. A microphone attached tightly with string to the surface casing is connected through a 25-foot extension cord to the input of the amplifier and thence to the headphones. A volume control regulates the intensity of the sound in the headphones.

Field use.—The apparatus in its portable case is placed as far as possible from the rig in order to reduce the effect of the surface noises coming from the motors and other machinery. A desirable position is within a closed automobile parked at a convenient distance. Equipped with a pair of tightly fitting headphones, the listener increases the volume of the amplifier until the sound from the bit excludes external surface noises from the motors, rotary table, chains, etc. As previously stated, the sound generated by the bit varies in pitch, tone, etc., according to the character of the rock being penetrated. The listener can usually pick up changes which are also indicated by change in drilling time, and with practice he can more or less definitely associate certain sounds with certain kinds of beds, such as limestone, coal, sandstone, etc. The description which will be given by different listeners to sounds produced by different rocks is probably of no great significance because the sounds vary with the speed of the bit and possibly for other reasons. The important point is that distinguishable differences in sound exist.

Use of device in preparing logs.—The potential usefulness of the device, if perfected, would be mainly for locating precisely the position of abrupt changes in the character of rock strata and hence for determining the thickness of lithologic units. It should be particularly useful in locating the positions of the tops and bottoms of coal beds. It would probably make possible more precise estimates of the depth at which changes in strata occur than is provided by the drilling-time log. The amount of the lag in the delivery of cuttings to the surface could therefore be estimated more accurately.

Limitations and possibilities.—There are two important considerations limiting the use of this sound device. The first is the personal element involving the individual reaction to and interpretation and description of the sounds received. It is essentially impossible to record the impressions objectively as a sound picture having quantitative or qualitative meaning. The second limitation is the listener's fatigue from the violent noises produced when the amplification is enough to eliminate the surface noises. The limit of endurance is between 4 and 5 hours of continuous listening. Because of this effect the device is used mainly to pick changes in lithology and thicknesses of black shale ("slate"), coal and underclay where the positions of such beds are known within 50 to 75 feet. Continuous listening therefore rarely exceeds two to three hours.

Having established the fact that there are audible variations in the sound produced by the bit working on different kinds of rock, it remains to substitute an oscilloscope for the headphones, or some other means for producing a visible and measurable sound pattern. The sound-logging device when perfected should record automatically sound, depth, and time, thus providing not only a record of the strata penetrated but a drilling-time record as well.

II. LABORATORY METHODS

A. Study of Cuttings

In general, the preliminary sample study made by the geologist at the well is adequate for establishing the position of the prominent coal beds, black shales, and limestones. Examination of the cuttings in the laboratory provides a check on the field determinations and also permits a more detailed description of all beds for which there are cutting-samples. In laboratory studies of this project, whether carried on in the field laboratory or at headquarters, a binocular microscope with a magnification of about 18 diameters has been used. The cuttings are usually examined immediately after cleaning while they are still wet.

Microscopic characteristics of individual strata.—Certain types of Pennsylvanian strata are identifiable only by microscopic examination. These particularly are silty and sandy rocks, such as silty shales, shaly and silty sandstones, and siltstones. Below the Herrin (No. 6) coal bed there are several hard calcareous sandstones which in the field may be mistaken for limestones. Some limestones also have peculiarities requiring microscopic determination. The fossiliferous caprock of Herrin (No. 6) coal bed appears microscopically only as a typical dark gray to black rock with sugary texture. The reddish and variegated colors of the shale accompanying the so-called "West Franklin" limestone of southeastern Illinois are likely to be overlooked unless observed microscopically.

Coal is comparatively light and will usually float on a liquid having a specific gravity of about 1.4, whereas associated rock materials have a specific gravity well above 2.0 Coal is therefore lighter in weight than the black shales or "slates" with which it is commonly associated and confused. Because of its brittleness, drills break it up into small irregularly shaped angular particles among which, with the aid of the microscope, can usually be found fragments of jet-black vitrain with brilliant luster and glass-like fracture. The irregular shape of the coal fragments is in contrast to the subrounded to angular fragments and flattened "splinters" of shale and black "slate." Some fragments may be large enough to reveal microscopically the banded or laminated structure characteristic of the bituminous coal beds of the Illinois basin. Cannel coal rarely occurs in the "Coal Measures" of Illinois, and differentiation of such coal from black "slate" would require very discriminating identification, but the possible presence of such coal here and there in the succession should be kept in mind.

Correlation of the sample-study log with drilling time.—The drilling-time log is essentially a record of variations in lithology. Limestone, calcareous sandstone, and calcareous siltstones drill relatively slowly, whereas black "slate," coal, and underclay drill relatively fast, as has already been stated. In correlating the samples with the drilling time the practice is to draw up first the drilling-time curve on the logging-strip, with notations concerning connections, trips, and special samples taken. The sample study is then recorded graphically upon the strip, the various beds represented in the drill-

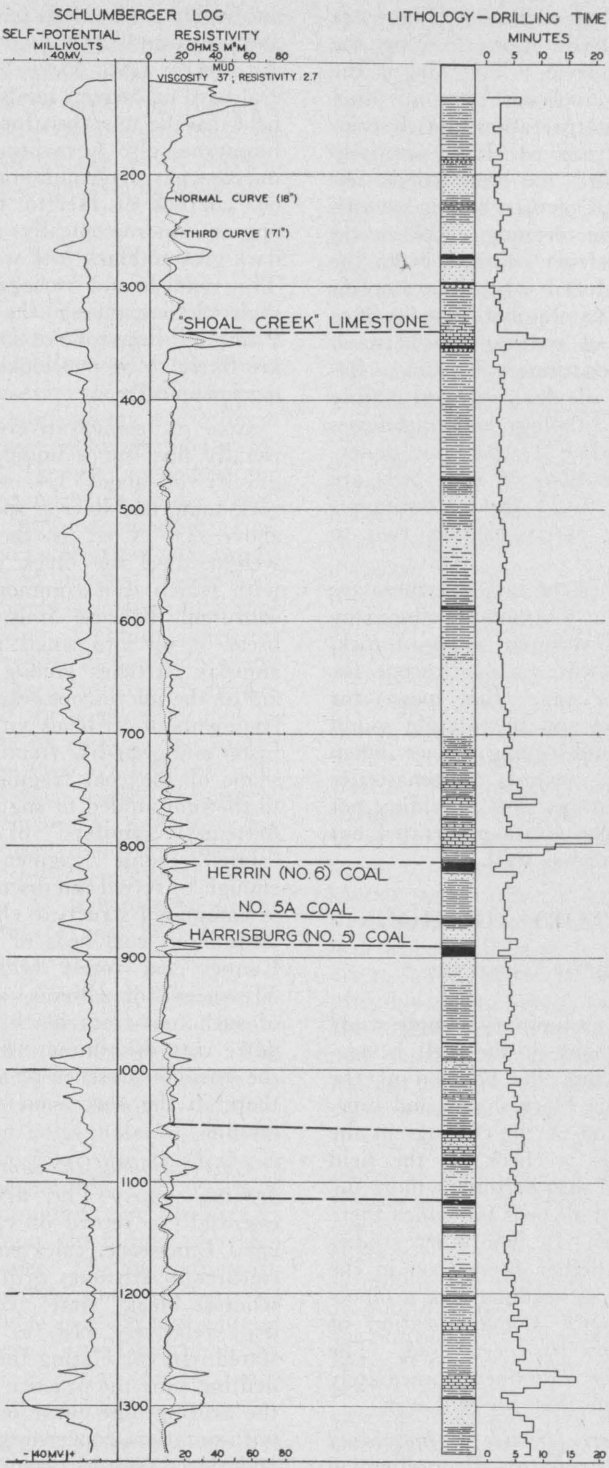


FIG. 2.—Comparison of electric, lithologic, and drilling-time records of Lewis Producing Co.—State well No. 1.

cutting samples being placed at their correct depth in accordance with the drilling-time record with appropriate corrections for lag. A perusal of the drilling-time log prior to the study of the cuttings helps to forecast the probable character of the cuttings at various depths. If the cuttings are studied without consideration of the drilling-time record, important characteristics and components of the cutting-samples are likely to be ignored.

Graphic representation.—Log strips prepared by the Coal Division show drilling time by a single red line to the right of the lithology column (fig. 2). Written descriptions in black ink may cross this line but do not obscure it. The graphic logs are drawn on two special scales—on a scale of 20 feet to the inch for detailed study of sequences of thin coal beds and limestones and on a scale of 50 feet to the inch for general correlation purposes and particularly for direct comparison with electric logs. Drilling time is usually plotted horizontally on a scale of 1/10-inch equals 30 seconds, a relationship which is generally appropriate for recording drilling time at 2-foot intervals within the Pennsylvanian formations. A faster drilling time or intervals less than 2 feet require an increase in the scale so that 1/10-inch equals 15 seconds.

B. Use of Electric Logs in Interpreting the Pennsylvanian Succession

Electric logs are represented by two types of diagrams: (1) A potential diagram, and (2) one or more of several resistivity diagrams, including impedance diagrams.

The potential curve records the natural electric potential at successive levels in the drill-hole and is usually shown on the left side of the so-called electric log. The phenomena expressed are ascribed primarily to electro-filtration and electro-chemical concentration.[2]

The resistivity curves, usually shown on the right-hand side of the electric log, record differences in the apparent electric resistance of the strata penetrated. Either resistivity or impedance is recorded by one or more of the several curves: (1) A "normal" resistivity curve, which is recorded with the electrode spacing in the well of about 18 inches or with a single electrode, and (2) one or more "third" curves produced by various electrode spacings greater than 18 inches. Different electrode spacings produce different amounts of "penetration" of the same beds and hence result in slightly different patterns in the electric log.[3]

General value of electric logs.—Even without a knowledge of the technical procedure and principles involved in electric logging, when a number of such logs of wells for a local area are compared with one or more accurately compiled geological logs, it is clear that certain portions of the succession can be identified with reasonable certainty by the characteristic pattern of the electric logs. This constitutes the main general value of the electric logs in connection with the present studies of the Pennsylvanian strata. Brief consideration will be given to certain generalizations in regard to the behavior of the different curves, particularly at beds of limestone and coal, but it should be realized that exceptions to the generalizations may exist in other areas and that the value of the electric logs in a specific area, at least so far as the Pennsylvanian succession is concerned, depends upon the availability of authentic geological records as bases of reference. This is one of the great values of time-logging which enlarges the usefulness of the electric logs in the interpretation of the structure and stratigraphy of the Pennsylvanian system.

Conductivity of coal beds.—Sinkinson[4] concluded from determinations of the conductivity of a number of American and Scottish coals that coals with less than 90 per cent carbon (dry basis) are essentially nonconductors, whereas those of higher carbon content are conductors. McCabe[5] found from laboratory experiments that of the three principal petrographic ingredients of Illinois coals, two—vitrain and clarain—are nonconductors when "dry," whereas the third ingredient—fusain—is a relatively good conductor whether dry or moist. By "moist" is meant the condition in the bed. Freshly mined Illinois coal does not appear wet, and the coal beds of Illinois rarely

2 Jakosky, J. J., Exploration geophysics, p. 679, Times-Mirror Press, Los Angeles, 1940 First ed., second impression.

3 The statement in this paragraph has been prepared in accordance with suggestions by R. J. Piersol, Physicist, and Carl A. Bays, Geologist and Engineer of the Survey staff.

4 Sinkinson, Eric, Coal conductivity cell: Ind. and Eng. Chem., vol. 20, No. 8, pp. 862-65, Aug. 1928.

5 McCabe, L. C., Some physical evidence of development of rank in vitrain: Fuel in Science and Practice, vol. XVI, No. 9, pp. 275-79, Sept. 1937.

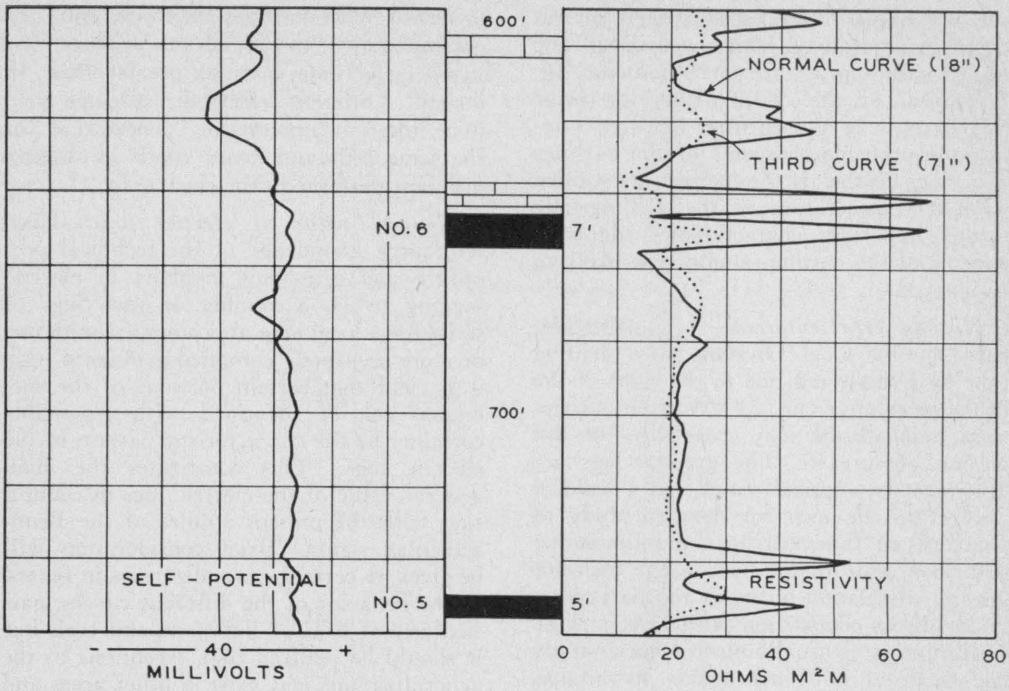


FIG. 3.—Resistivity pattern of coal beds Nos. 5 and 6.

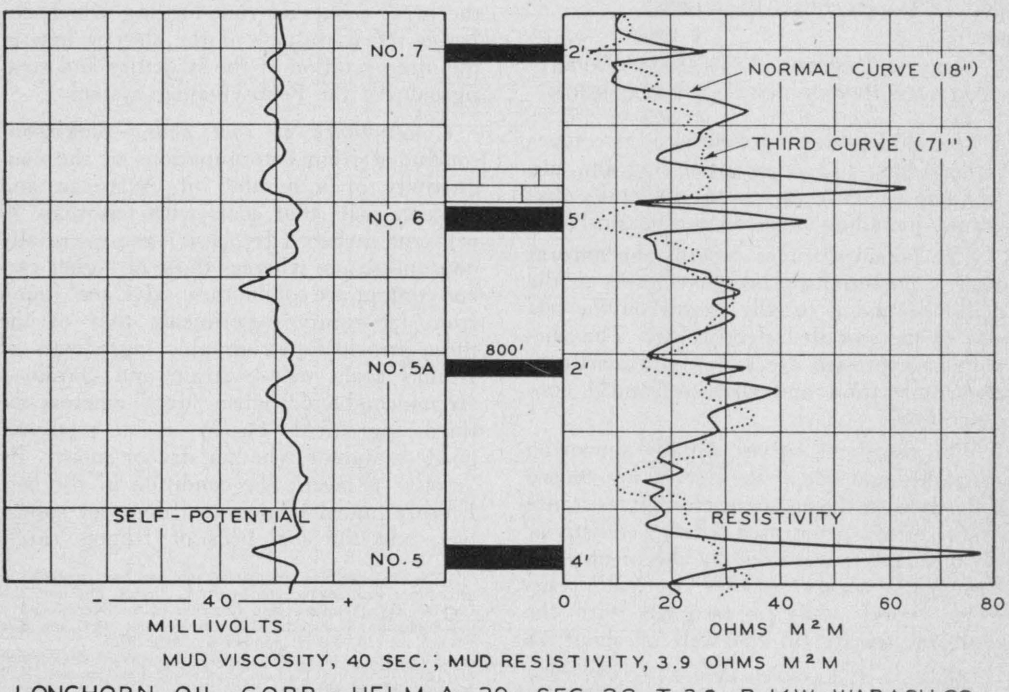


FIG. 4.—Resistivity pattern of coal beds Nos. 5, 5A, 6, and 7.

serve as aquifers in the sense that they contain moisture in excess of that combined with the coal material. McCabe points out that even "moist" vitrain, although more conductive than "dry" vitrain, has a conductivity considerably less than "dry" fusain. Conductivity of laboratory samples of coal, therefore, probably depends primarily upon rank and to some extent upon the fusain content. It is probable that coal beds rarely contain enough fusain to affect their conductivity materially, but the possibility that occasionally a bed locally may be composed largely of fusain and have higher conductivity should not be ignored.

Resistivity pattern of coal beds in electric logs.—The coal beds of the Illinois basin are of high-volatile bituminous rank, and aside from the combined or bed moisture which is one of the factors in determining the rank of the coal, the beds are essentially dry and without visible moisture. Because the coal itself is a poor conductor and the coal beds do not usually act as aquifers and are hence dry in the sense that they do not contain free moisture, their position in drill-holes is generally indicated by a relatively high peak in the normal resistivity pattern.* However, similar peaks are also characteristic of limestone beds; hence, in interpreting electric logs it is necessary to be able to differentiate between limestone and coal. This cannot be done with assurance unless other information concerning the general stratigraphy of the area under consideration is available.

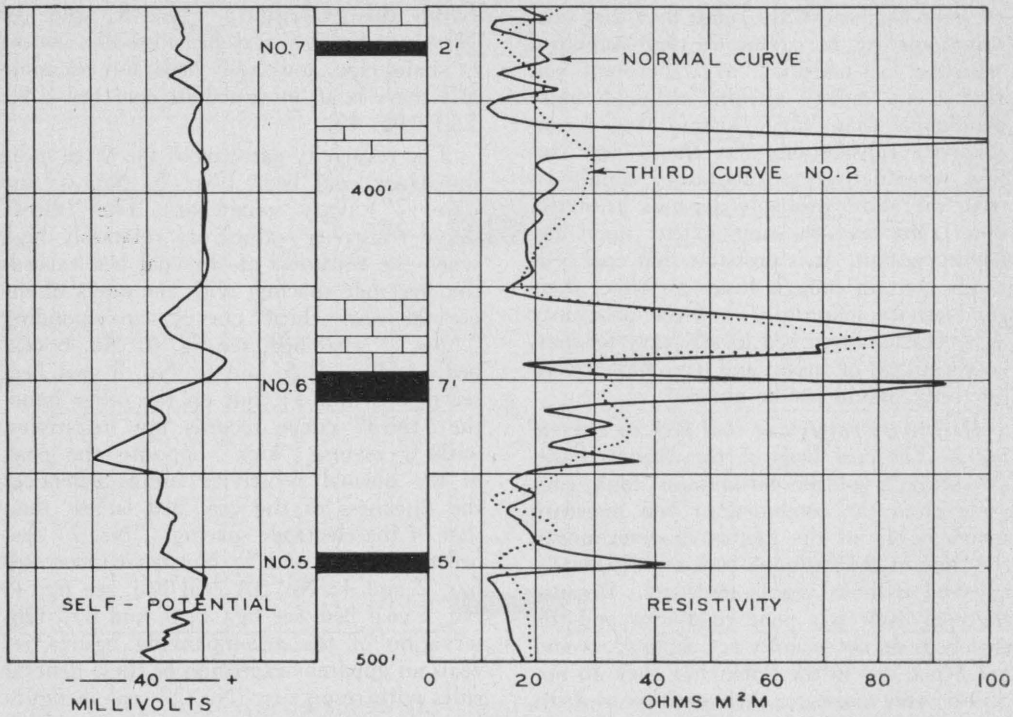
In this connection it may be pointed out that there is a certain pattern of geological sequence characteristic of that part of the Pennsylvanian succession from the Harrisburg (No. 5) coal bed to the "Danville (No. 7)" coal bed that is generally useful in the identification of this part of the succession in southern Illinois. This geological sequence in southern Illinois usually includes the persistent limestone caprock of the Herrin (No. 6) coal bed (figs. 3 to 6), the Herrin limestone, in places a second limestone between the Herrin limestone and the "Danville (No. 7)" coal bed (figs. 5 and 6), and locally a limestone a short distance above the "Danville (No. 7)" coal bed (fig. 5). The strata intervening between the Harrisburg (No. 5) and the Herrin (No. 6) coal beds usually consist of shale, clay, and sandy beds, but occasionally there is an intermediate coal bed (No. 5A) (fig. 4).

The resistivity patterns of the three more important coal beds (No. 5, No. 6, and "No. 7") vary somewhat. The "third" curve resistivity values are relatively high when the thickness of the coal bed exceeds the electrode spacing, with the peaks of the normal and third curves corresponding ("No. 7" coal bed, see fig. 6; No. 6 coal bed, see figs. 3, 5, and 6; No. 5 coal bed, see figs. 3 and 4), but on the other hand, the "third" curve records low resistivity, with a reverse "kick" opposite the peak of the normal resistivity curve, whenever the thickness of the coal bed is less than that of the electrode spacing ("No. 7" coal bed, see figs. 4 and 5; No. 6 coal bed, see figs. 2 and 4; No. 5A coal bed, see fig. 4; No. 5 coal bed, see figs. 2, 5, and 6). Observation of the accompanying figures reveals an apparent exception to these general rules with respect to "No. 7" coal in figure 6 where the "third" curve shows a peak although the record compiled from time logs and cuttings indicates that the coal was relatively thin. The fact that the normal curve shows a double peak suggests the possibility that the coal bed may have a parting but other causes may produce the same effect. A low resistivity "third" curve pattern is probably the most common because the prevailing thickness of the coal beds is less than 6 feet.

The thickness of the coal beds noted on figures 2-6 was determined by observation of drilling time and the collection of drill-cuttings. In the No. 1 Anderson well (fig. 3) the thickness as determined is in close agreement with the thickness of a coal reported in a log of a diamond-drill hole less than one-half mile distant in the same section (American Coke and Chemical Company hole No. 5).

The coal beds of the McLeansboro group above "Danville (No. 7)" coal bed are not yet well enough known to differentiate their curve patterns in electric logs. The electric logs of some drill-holes known to penetrate thin coal beds at certain depths show a slight peak (fig. 2, 588-590 feet) or a slight reentrant (fig. 2, 297-398 feet) in the normal resistivity curve at the appro-

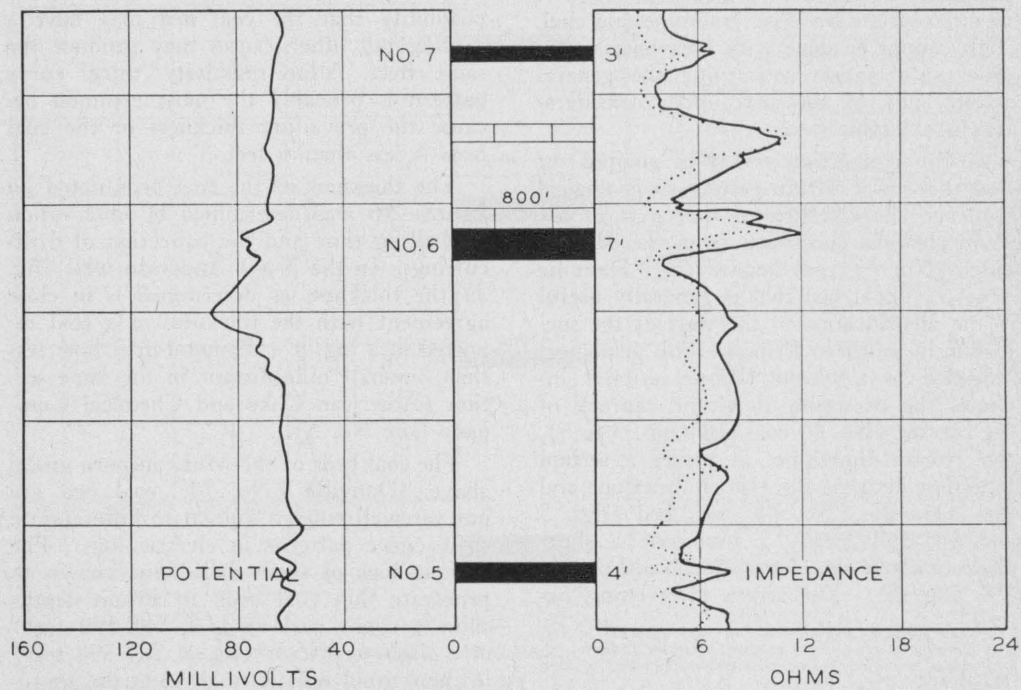
*Note: Although the working faces may generally be dry, it is reported by some engineers that in entries driven rapidly ahead of the working face considerable free water is often encountered.



MUD VISCOSITY. 49 SEC , MUD RESISTIVITY, 3.0 OHMS M²M

E.S. ADKINS - ICE 1, SEC. 21, T 7S.,R.3E , FRANKLIN CO.

FIG. 5.—Resistivity pattern of coal beds Nos. 5, 6, and 7.



MUD VISCOSITY, 40 SEC., MUD IMPEDANCE, 7.6 OHMS

SUN OIL - C.W. FORD B-4, SEC. 21, T. 4S.,R.14W.,WHITE CO.

FIG. 6.—Resistivity pattern of coal beds Nos. 5, 6, and 7.

priate positions. A slight peak may be produced by the coal bed, a thin limestone, or both, whereas a reentrant may represent a thin coal bed and relatively thick underclay or just an underclay.

In some drill-holes the presence of coal beds below the Harrisburg (No. 5) bed is indicated by the pattern of electric logs. The details of this succession are at present being worked out.

Underclays.—The underclays of coal beds and beds of the "underclay" slip-fracture type have a conspicuously low resistivity. The presence of such beds is therefore usually indicated by a sharp reentrant in the normal resistivity curve which commonly occurs immediately beneath a resistivity peak representing the position of a coal bed (figs. 2-6). Occasionally an "underclay" may occur in the midst of a shale succession unaccompanied by a coal bed, and the occurrence of such beds of clay may explain small reentrants here and there in the normal resistivity curve.

The potential pattern of coal beds.—The pattern of the potential curve across the position of coal beds is variable and up to the present this variability is not understood. In many instances considerable negative potential is recorded opposite coal beds (figs. 2, coals No. 5 and No. 6; fig. 4, coal No. 5). If the potentials recorded are caused by electro-filtration alone, no such negative potentials would be expected from coal beds, if, as is thought, the permeability of such beds is low. These negative potentials may be due to local porosity of the coal beds for some reason or other, to electrochemical phenomena, or to other causes not understood.[6]

III. SPECIAL APPLICATION OF DRILL-HOLE STUDIES

Profile section across Wayne County.—A north-south profile or cross-section of Wayne County (pl. 1) using stratigraphic and electric logs shows how similarity in stratigraphic succession in the McLeansboro group is matched by similarity in the pattern of the electric logs. According to the stratigraphic logs a number of individual formations appear to be continuous along the line of the profile. A limestone member at about 400 feet and the one at about 200 feet above the Herrin (No. 6) coal bed are particularly noteworthy because of their continuity.[7] Their positions are prominently indicated on electric logs. The sequence of beds extending from the "Danville (No. 7)" bed down to the Harrisburg (No. 5) coal bed contains several coal beds, limestones, and underclays, as described in a preceding paragraph, which produce a fairly characteristic pattern of prominent peaks and valleys in various curves of the electric log. This succession is known from drilling-time and stratigraphic records to be composed of a sequence of beds interpreted as representing four separate cyclothems.[8]

Within these four cyclothems certain beds are of particular interest. The uppermost coal bed, possibly the "Danville (No. 7)" bed, is a thin layer, the presence of which may be indicated by a slight peak in the normal resistivity curve. Below this coal the beds commonly occur in the following order down to the Herrin (No. 6) coal bed: Underclay, non-fossiliferous "fresh-water" limestone, shale, sandstone or sandy shale, argillaceous shale, and limestone caprock of Herrin (No. 6) coal bed (Herrin limestone). The No. 6 coal bed usually lies 40 to 70 feet below the upper ("No. 7" ?) coal bed. The pattern of the normal resistivity curve produced by the Herrin limestone and No. 6 coal is distinctive and the most prominent part of the graph in this particular part of the profile, thereby providing a key for locating the position of less prominent strata. Between the Herrin (No. 6) and the Harrisburg (No. 5) coal beds strata are variable. Sandstones and sandy shales predominate. A coal bed, No. 5A, is occasionally present within about 25 feet above the Harrisburg bed and a "fresh-water" limestone may be present a few feet below the Herrin coal bed. The electric logs usually reveal the presence of the limestone but may or may not record the presence of the No. 5A coal bed. The Harrisburg (No. 5) coal is commonly about 75 feet below the No. 6 coal bed. It rarely possesses a caprock. It usually produced a relatively high peak in the normal resistivity curve.

6 For this statement on potential pattern, the authors acknowledge their indebtedness to Carl A. Bays of the Survey staff.

7 Sims, Paul K., Payne, J. Norman, and Cady, Gilbert H., Pennsylvanian key beds in Wayne County and the structure of the "Shoal Creek" limestone and the Herrin (No. 6) coal bed: present report pp. 27-32.

8 Wanless, Harold R., and Weller, J. Marvin, Correlation and extent of Pennsylvanian cyclothems: Bull. Geol. Soc. Amer. vol. 43, p. 1003, Dec. 30, 1932.

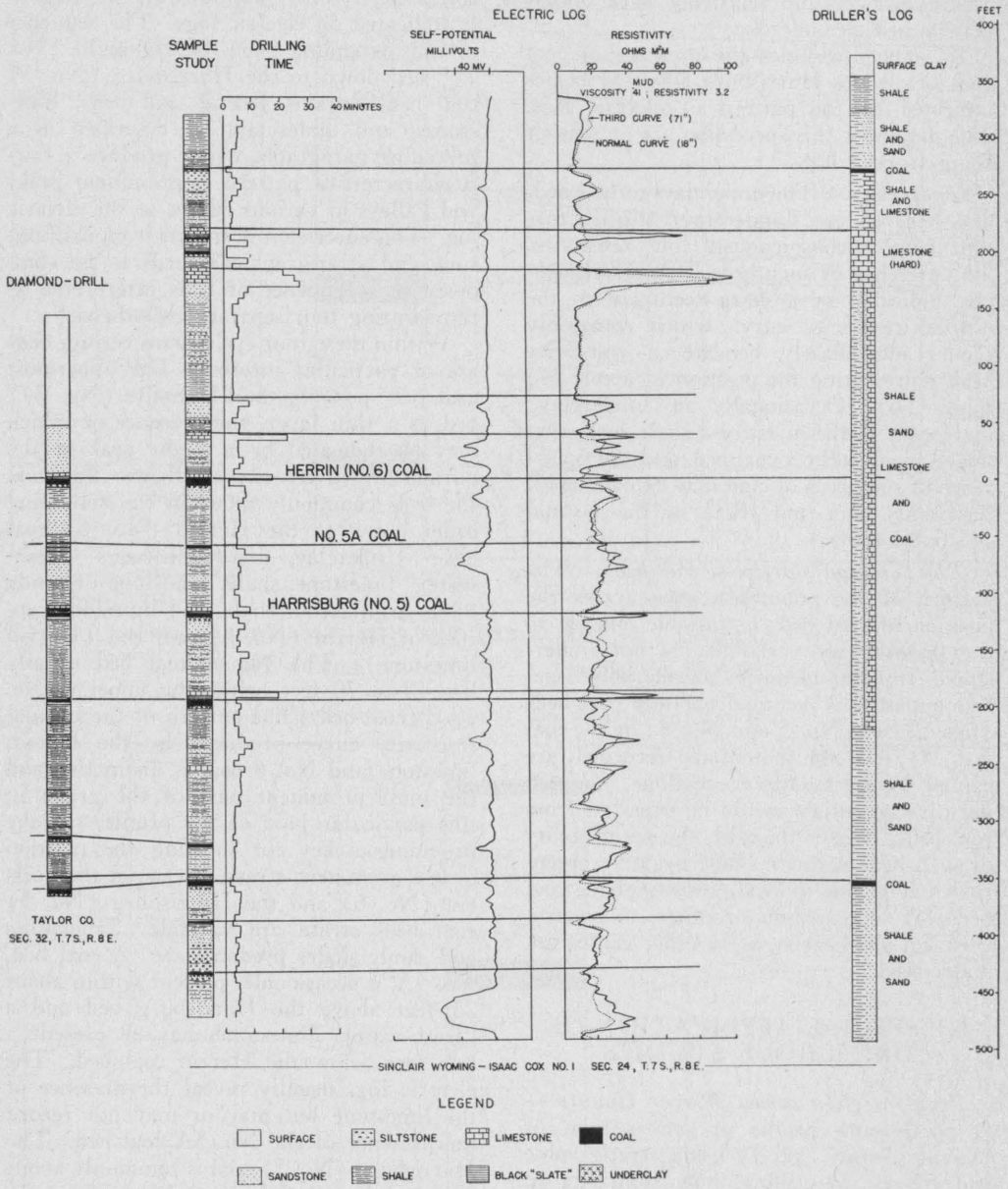


FIG. 7.—Comparison of diamond-drill log and drilling-time, cuttings-study, electric, and driller's logs in Gallatin County.

Comparative study of diamond-drill and rotary-drill logs from Gallatin County.— The most accurate records of the sedimentary succession in Illinois are obtained by an examination of diamond-drill cores. Such records are practically complete, and measurements of depth and thickness of individual strata subject to only small errors. Unfortunately, however, few diamond-drill records are available in those parts of the Illinois basin where rotary tools are being used almost exclusively. A comparison of drilling-time logs, logs compiled from drill-cuttings, and electric logs with the records of adjacent diamond-drill holes where available, demonstrates that the records obtained from a rotary-drill well, if the data are carefully collected and correlated in accordance with the methods that have been outlined, are in remarkably close agreement with diamond-drill records.

Figure 7 provides a graphic comparison of the log of the Byrd-Taylor diamond-drill hole (SW. ¼ SW. ¼ SW. ¼ sec. 32, T. 7 S., R. 8 E., Gallatin County) and the drilling-time log, the log compiled from study of drill-cuttings, the electric log, and driller's log of the Sinclair-Wyoming Isaac Cox No. 1 well (SW. ¼ SW. ¼ SW. ¼ sec. 24, T. 7 S., R. 8 E., Gallatin County) 4½ miles northeast of the diamond-drill hole. Of the three records available for the Cox well, the log based on drilling-time and cuttings is the most dependable and useful for stratigraphic and structural studies, as the lithology is shown in detail with accurate depth and thickness measurements for individual beds. A detailed record such as this cannot be obtained directly from the electric log and is rarely supplied by the driller.

The electric log displays definite pattern irregularities which may be used in the interpretation of other electric logs of wells in the same general region. It also provides a means of checking measurements of the depth and in some cases the thickness of individual beds that have been located and measured by time-logging.

The driller's log of the Cox well is practically useless. The two coal beds and the limestone bed shown in this log happen to have been identified by members of the Coal Division of the Survey who were at the well at the time the strata were penetrated. Except for the driller's log, however, the succession of coal and limestone beds shown in the logs of the Cox well in figure 7 is in remarkably close agreement with the sequence logged in the adjacent diamond-drill hole. Coal beds at the same positions and less than one foot thick are listed in both records.

In conclusion, it should be emphasized that most standard methods used in logging rotary-drill wells produce records which are far less accurate than that obtained from the average diamond drill core. However, it is possible, using the techniques described in this report, to obtain from rotary-drill wells a remarkably accurate record of the sedimentary succession of the Pennsylvanian beds in spite of the rapidity of drilling and the great possibility of the contamination of cuttings.

STRUCTURE OF THE MILLERSVILLE LIMESTONE IN THE NORTH PART OF THE ILLINOIS BASIN

BY

EARLE F. TAYLOR AND GILBERT H. CADY

THE AREA included in this study comprises all of Cumberland, most of Coles, Shelby, and Moultrie, the north half of Effingham, and parts of Douglas, Macon, Fayette, and Jasper counties, extending from T. 8 N. to T. 15 N., and from R. 3 E. to R. 11 E., except T. 14 N., R. 10 E. (fig. 8).

DESCRIPTION OF THE MILLERSVILLE LIMESTONE

The limestone called Millersville in this report is believed to be the same as the limestone poorly exposed in sections 28 and 34, T. 12 N., R. 1 W., near the town of Millersville in Christian County, from which place its name is taken. In outcrops the limestone is gray to buff, crystalline, fossiliferous, with interbedded shales. Near the base of the member is a porous coquina composed of an aggregate of small spheroid-shaped particles with chalky incrustations and fairly numerous minute fossils, of which algae, fusulinids, and other foraminifera are an important part at some localities.

The Millersville limestone within the area mapped is known only from drill cuttings. These are described as brownish to brownish-gray, fossiliferous, finely textured, dolomitic and dense to lithographic in some cases. Cuttings of the light colored coquina member as described in the preceding paragraph have also been observed, usually coming from the lower part of the limestone.

In most of the area the Millersville limestone is 30 to 50 feet thick (only 5 to 6 feet of limestone are exposed near Millersville) and includes one or more prominent shale beds. In the southern part of the area the shaly content increases at the expense of the limestone, and in the central part of the southern portion of the area the member is less persistent than to the east or west. There is possibly a slight tendency for the limestone to separate into two relatively thin benches to the south owing to the thickening of the intermediate shale bed.

CORRELATION

The Millersville limestone lies about 600 feet above the Herrin (No. 6) coal bed and 40 to 50 feet below the Upper Bogota limestone in the vicinity of the Louden pool.[1] At the west edge of the area mapped, in R. 3 E., the limestone is from 100 to 150 feet below the surface.

This bed has been variously called LaSalle,[2] New Haven,[3] Carthage,[4] and Livingston[5] limestone. Newton's LaSalle limestone in the vicinity of the Louden pool (pl. 2), T. 8 N., R. 3 E., is the same as the Millersville limestone of this report, but Newton's LaSalle limestone present in test-holes farther to the east, near Neoga, T. 10 N., R. 6 E., Cumberland County, is not the same as the Millersville limestone of this report but is believed to be a limestone about 300 feet higher.

The correlation of the Millersville limestone with the LaSalle limestone of northern Illinois is regarded as doubtful. Dunbar and Henbest[6] have identified one of the fusulinids found in the outcropping Millersville limestone as *Triticites venusta* n. sp., and another more common one as *Triticites ohioensis* Thompson, and suggests the possibility of correlation with beds near the base of the Conemaugh group in Ohio and also with a limestone (Livingston or Marshall ? limestone) which is exposed in the S. ½ SE. ¼ NE. ¼ sec. 10, T. 14 N., R. 11 W., Edgar County, near Tresner Church. This last limestone, herein designated the Tresner limestone, lies about 175 feet above No. 7 coal bed, and the Marshall limestone in Crawford County lies about

1 Newton, W. A., Surface structure map of Shelby, Effingham, and Fayette Counties: Illinois Geol. Survey Rept. Inv. 76, pp. 7, 16, 1941.
2 Newton, W. A., op. cit., pp. 6, 12-21.
3 Kay, F. H., Coal resources of District VIII: Illinois Geol. Survey Coop. Min. Inv. Bull. 11, p. 26, 1915.
4 Kay, F. H., op. cit., p. 28.
5 Dunbar, Carl O., and Henbest, Lloyd G., Pennsylvanian Fusulinidae of Illinois: Illinois Geol. Survey Bull. 67, p. 163, Sta. 490 (called Livingston limestone), and p. 131, 1942.
6 Dunbar, Carl O., and Henbest, Lloyd G., op. cit.

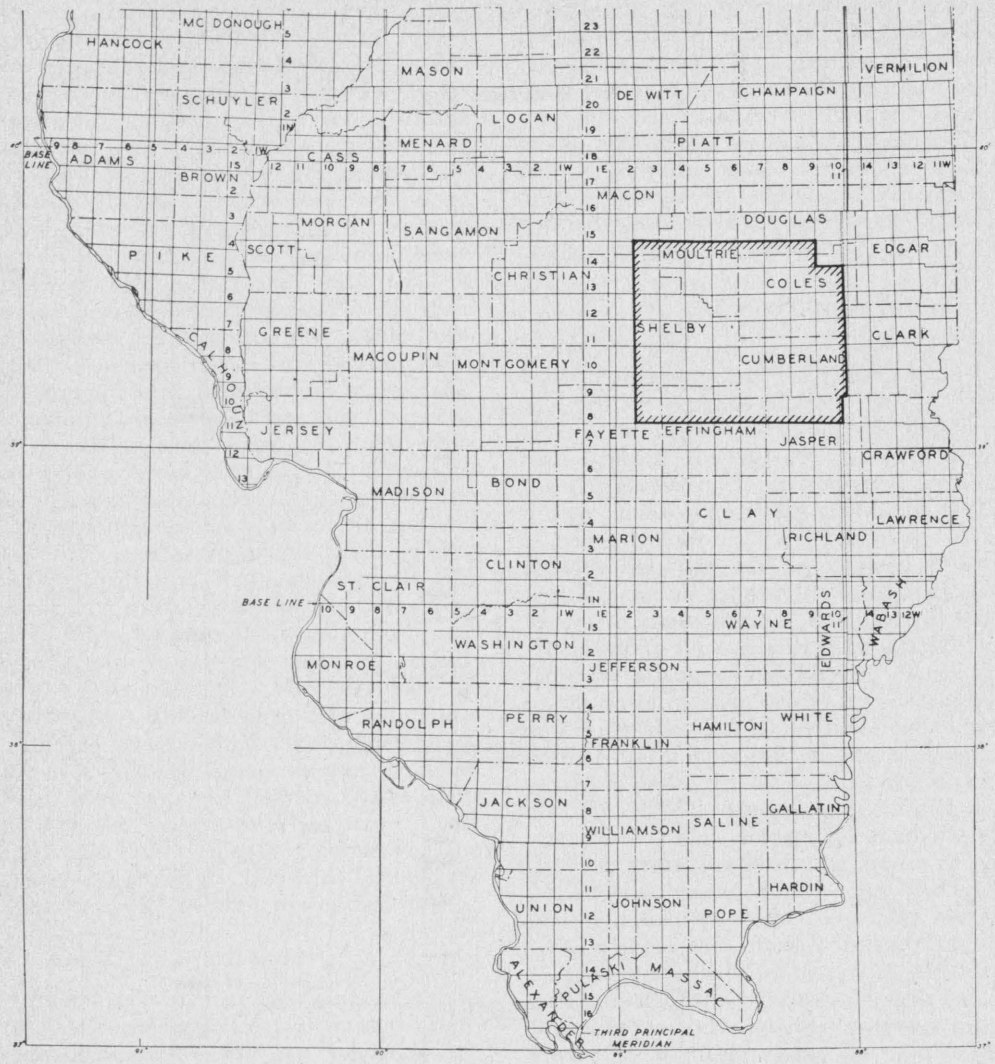


FIG. 8.—Index map of area covered by structure map of the Millersville limestone.

300 feet above No. 7 coal bed, whereas the Millersville limestone lies between 500 and 600 feet above the position of a coal bed thought to be No. 7. Thus, in spite of the evidence of the fusulinids, the correlation of the Tresner, Marshall (or Livingston ?), and Millersville limestone as representing the same stratigraphic position is regarded as not established.

Inasmuch as the area represented in plate 2 coincides closely with the area in which the Millersville limestone can be recognized in subsurface studies, it is possible that the distribution of this member is of limited extent and that no limestone member is exactly correlative with it beyond the boundaries of this area, particularly southward. If limestone is present at this horizon to the south or southeast it must be one considerably thinner than the Millersville limestone where it is characteristically developed.

Concerning the identification of the Millersville limestone in the southern part of the Louden pool, particularly in the south part of T. 8 N., R. 3 E., Fayette County, there is some uncertainty. This is a very small part of the mapped area (pl. 2).

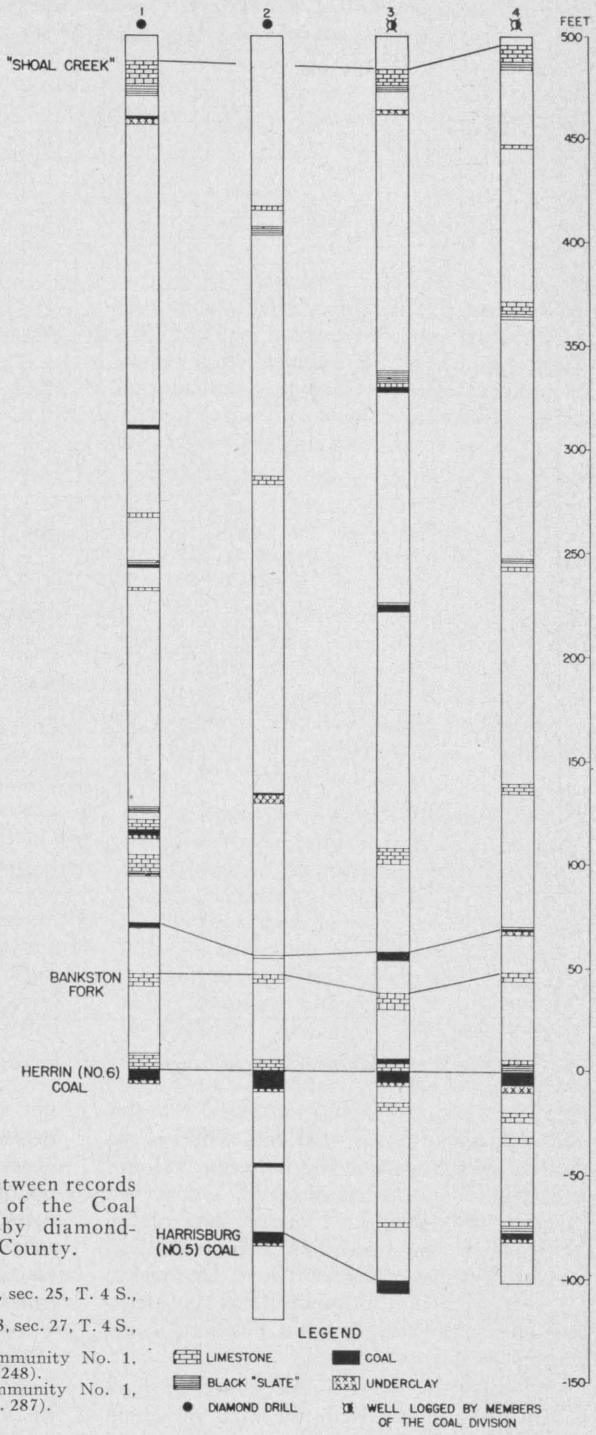


FIG. 9.—Diagram showing comparison between records of wells logged by members of the Coal Division and records of near-by diamond-drill cores, in southern Wayne County.

1. Delafield Coal Co., Hamilton Co. No. 1, sec. 25, T. 4 S., R. 5 E.
2. Elm Grove Coal Co., Hamilton Co. No. 3, sec. 27, T. 4 S., R. 6 E.
3. Texas Oil Co., Buchanan—Butler Community No. 1, sec. 8, T. 3 S., R. 6 E. (Wayne Co. No. 248).
4. Deep Rock, Atkinson—Windland Community No. 1, sec. 12, T. 2 S., R. 6 E. (Wayne Co. No. 287).

There are in this general locality three fairly thick limestone members in the upper part of the McLeansboro group, the uppermost of which is herein correlated with the Millersville limestone. However, when the succession is compared with those appearing in records of drill holes and mine shafts in western Fayette, Montgomery, and Bond counties, as has been done by J. Norman Payne in connection with studies being made on the structure and stratigraphy of those counties, there appears to be some justification for regarding the middle limestone as Millersville. In the Louden pool the intermediate limestone is of sporadic occurrence but 20 to 40 feet of it have been penetrated in some holes. The discontinuous character of the limestone appears to be consistent with a general tendency of the Millersville limestone to disappear from the succession southward in the Illinois basin. On the other hand, from a study of the drill records of those holes which are mapped, it is concluded that the lowermost of the three persistent limestone members is equivalent of one called the "West Franklin" in southeastern Illinois which does not appear to extend much beyond the west border of the area being discussed. Hence, it is believed that the upper limestone in the south part of the Louden pool is correctly correlated as Millersville, the intermediate one being the limestone generally known as "Shoal Creek" (Carlinville of Kay).[4]

Structure

The structure map (pl. 2) is based entirely upon subsurface data because the Millersville limestone does not appear at the surface in the area mapped. Records of rotary-drill holes constitute the principal source of data, but logs of diamond-drill holes and of cable-tool holes, electric logs, studies of well-cuttings, and drilling-time records were also used. In heavily drilled areas electric logs were preferred to other types of records for the same wells because the position of the top of the limestone can be determined with greater precision. Considerable information has already been assembled and published for Ts. 9 and 10 N.[7]

Except for holes located within the Louden pool, drilling is widely scattered, and holes in the logs of which the Millersville limestone can be recognized are even more sparsely scattered. The distribution of the data does not justify closer structure contour intervals than twenty-five feet except in the area of the Louden pool and this is but a relatively small part of the entire area. Consequently, the map is generalized and indicates only the approximate position of the top of the limestone.

Use of the Structure Map

Protection of coal beds.—Since the Millersville limestone and the Herrin (No. 6) coal bed are roughly parallel, the map provides a means of determining the approximate depth to the coal bed at any place on the map across which the contours have been drawn. Since the surface altitude of wells is generally known, the depth to the Millersville limestone can be obtained by subtracting the altitude of the coal indicated by the contour nearest the selected spot. The depth to the coal will be about 600 feet more for all places on the map except the south-central portion, where it will be about 630 below the Millersville limestone. Thus, in the case of hole No. 4, Jasper County, sec. 7, T. 8 N., R. 10 E., since the surface altitude is 579 above sea-level, and the structure contour nearest the drill hole is 25 feet above sea-level, the depth to the Millersville limestone is 554 feet or 554 + 600 = 1154 feet to the top of the Herrin (No. 6) coal bed. At the present time, information available in regard to the presence and thickness of the No. 6 coal bed in this area scarcely justifies ordering plugs always to be placed from 550 to 650 feet below the Millersville limestone in order to protect the coal bed should it be present. It does, however, justify a suggestion that drilling be carefully conducted to determine whether or not a workable bed is present at the indicated depth below the Millersville limestone so that it can be protected if encountered. Failure to take this precaution may result in negative unreliable evidence which calls for protection at the stratigraphic position of the coal bed regardless of lack of definite proof of the presence of coal in workable thickness.

It is not improbable that in parts of this area there are workable coal beds present below the Herrin (No. 6) coal bed. Care should therefore be exercised in drilling

7 Cady, G. H., Significant uncertainties in Pennsylvanian correlation in Illinois coal basin: Illinois Geol. Survey Cir. 57, pp. 1514-17, 1939. (Reprinted from Bull. Am. Assoc. Petr. Geologists, vol. 23, No. 10, pp. 1507-24, 1939.)

from 600 to about 1000 feet below the Millersville limestone in order to determine the depth and distribution of such coal beds so that they can be properly protected if encountered.

Prospecting for oil and gas.—A generalized structure map, such as that accompanying this report, permits the delineation of only major structural irregularities in the "lay" of the beds. Minor structural features which are often important in determining the position of small but often important pools fail to show up because of the large contour interval and the sparse distribution of structure data. Continued drilling will bring to light many minor structural features that cannot now be shown. The map, therefore, should be used cautiously as a guide for exploration not only for these reasons but also because of the probable lack of parallelism of the Pennsylvanian beds and those of Mississippian and older age in which most Illinois oil and gas resources are found in Illinois. The structure of the lower beds may be sufficiently different from the structure of the Millersville limestone so that at least minor structural features of the limestone are entirely smoothed out in the older beds.

The map may be found useful to those interested in structure drilling in indicating the approximate altitude of the Millersville key limestone over a large area in the Illinois basin.

Comparison with the Structure of the Upper Bogota Limestone

In 1941 the Survey published a structure map of the Upper Bogota limestone[8] for a considerable portion of the area represented by plate 2 of the present report. There is considerable difference in the details of the structural features delineated by the two maps. If both maps are correct, the Millersville limestone and the Upper Bogota limestone and associated beds are clearly not parallel. However, the differences in the delineated structural features of the two Pennsylvanian members are believed to be due to erroneous assumptions in regard to the stratigraphic interval between the datum bed and certain index beds in the area mapped in 1941. The present map, on the other hand, is based entirely upon the altitude of a single limestone member identified in the individual drill-record mainly by its characteristic thickness. The authors are fully aware of the pitfalls of "log-matching" in the construction of structure-contour maps and, in view of the common lenticular character of the Pennsylvanian limestones, of the possibility that the massive limestone member here assigned to the position of the Millersville may not lie at the same stratigraphic position at all places in the area.

8 Newton, W. A., op. cit., pl. 1.

Tabulated Data

The table (Appendix A) is a compilation of the data used in the construction of the structure map (pl. 2). The location of each datum point is given. The map index or county number, the type of drill-hole when not a rotary drill-hole, the name of operating company, and farm name and number are next shown in order. On the right-hand side of the page are given the surface altitude of the datum point and a symbol indicating how the surface altitude was determined, the total depth of the drill hole, the year drilled, and the depth, altitude, and thickness of the Millersville limestone.

PENNSYLVANIAN KEY BEDS IN WAYNE COUNTY AND THE STRUCTURE OF THE "SHOAL CREEK" LIMESTONE AND THE HERRIN (NO. 6) COAL BED

BY

PAUL K. SIMS, J. NORMAN PAYNE AND GILBERT H. CADY

WAYNE COUNTY lies near the geographical and structural center of the Illinois basin and has been one of the most widely drilled counties in the State.[1] In May 1943, oil pools in this county numbered 21, more than in any other one county.

The subsurface data available for determining the character of the Pennsylvanian beds underlying this county consist almost entirely of electrical, drilling-time, and driller's logs of rotary drill-holes, including 24 logs compiled from the study of well-cuttings, and a few logs of cable-tool holes. The records compiled from cuttings and drilling-time data are the most reliable and provide a key to the interpretation of the eletcrical logs of adjacent wells. From the available data, amounting to about 510 drill-records of various kinds in which one or more of the key beds could be identified, it has been possible to assemble fairly definite information concerning the position, and less definite information concerning the thickness, of certain key limestone beds of the McLeansboro group, of the "Danville (No. 7)" coal bed, and of the Herrin (No. 6) and Harrisburg (No. 5) coal beds.

TABULATED DATA

A tabulation of the data used as a basis for much of the following discussion and for the accompanying maps follows the report (Appendix). The table gives the location of each datum point within ten acres, the county number which is also the map number, and indicates the type of hole when it is other than a rotary drill-hole. The name of the operator or company responsible for the drilling is given. Drilling data include the surface altitude (or the altitude of the point from which measurements were made) and a key symbol indicating the source of information concerning the surface altitude; the year of drilling (abbreviated); the nature of doubt in regard to any information, also designated by a symbol; and the depth, altitude, and thickness of the key beds: coal No. 6, coal No. 5, and the "Shoal Creek" limestone.

Except for holes logged by the Survey time-logging field parties, thicknesses of coal beds are estimates based upon the interpretation of electric logs. Such estimates are probably about as reliable as thicknesses reported in logs of deep cable-tool drill-holes or in detailed driller's logs of rotary drill-holes, but possibly no more reliable. Continued experience in the careful logging of the Pennsylvanian beds in the Illinois basin and comparison of measurement of coal beds with the electric logs of the same holes, as such logs become available, should eventually make such estimates somewhat more trustworthy.

The thickness of the No. 6 and No. 5 coal beds is discussed in more detail later in the report.

KEY BEDS

POSITION AND CORRELATION

The members of the Pennsylvanian system which have been selected as key or index beds for Wayne County are the two limestone members commonly referred to by drillers and geologists working in the Illinois basin as the "Shoal Creek" and "West Franklin" limestones and three coal beds—"Danville (No. 7)," Herrin (No. 6), and Harrisburg (No. 5). These coal beds in this report are designated simply "No. 7," No. 6, and No. 5 respectively. The No. 6 coal bed is the uppermost member of the Carbondale group and the No. 5 coal bed

1 Carter, C. W., and Bell, A. H., Monthly Report Oil and Gas Drilling in Illinois: Illinois Geol. Survey Oil and Gas Drilling Report No. 79, pp. 5-8, May 1943.

is also in the upper part of this group. The bed designated "No. 7" lies near the base of the McLeansboro group, and the "Shoal Creek" limestone lies near the top and the "West Franklin" limestone about midway in the lower half of the McLeansboro group as present in this county. Probably at least 600 feet of strata comprise the portion of the McLeansboro group overlying the "Shoal Creek" limestone in this area. These strata probably include the horizon of the Millersville limestone described in the preceding paper, but this member has not been definitely recognized in Wayne County.

The use of the names "Shoal Creek" and "West Franklin" and "No. 7" in quoted form indicates uncertainty in regard to the accuracy of the correlations of the particular key beds with members named at the localities where the names were originally applied. With respect to the Shoal Creek limestone it signifies a more general uncertainty, because of a general vagueness of understanding of the correlative significance of this name in the Illinois basin.[2]

"Shoal Creek" limestone.—The Pennsylvanian member that is most readily identified in all forms of drill-hole records for the county is a limestone commonly encountered at depths ranging from 450 to 650 feet and tentatively regarded as the eastward continuation of the "Shoal Creek" limestone of Clinton County (pl. 3). In Wayne County this limestone generally lies between 450 and 475 feet above the coal bed believed to be No. 6, but it is apparently not widespread throughout the east part of the county (pls. 1 and 4).

Drill-cuttings of this rock consist of fragments of a dense very finely granular, white to buff limestone. The member is about 10 feet thick and is usually underlain by a few feet of black sheety shale ("slate") beneath which is commonly a thin bed of coal. The position of the "Shoal Creek" limestone is marked in electric logs by a pronounced narrow "peak" of high resistivity in the normal resistivity curve, a pattern which is sharply differentiated from that produced by overlying and underlying beds for a distance of 100 feet or more in either direction, for these beds generally show relatively low and uniform resistivity. This limestone is also commonly reported in drillers' logs.

2 Cady, G. H., Significant uncertainties in Pennsylvanian correlation in the Illinois basin: Bull. Amer. Assoc. Petroleum Geologists vol. 20, No. 10 (Oct., 1939), pp. 1507-1524, Reprinted as Illinois Geol. Survey Circular 57.

"West Franklin" limestone.—The limestone commonly called the "West Franklin" by drillers and geologists and tentatively correlated with the West Franklin limestone of Indiana[3] was penetrated in many holes at a position between about 175 and 250 feet above the No. 6 coal bed. It is about as conspicuous as the "Shoal Creek" limestone in logs of wells in which it was found, but it was less commonly reported or recorded, and for this reason the upper limestone seemed to be the more appropriate structure datum.

Drill-cuttings from this limestone are gray to buff in color and very fine-grained. Red shale is commonly associated with the "West Franklin," and the member is usually underlain by green to greenish-gray, very fine-grained calcareous sandstone or siltstone. A thin coal bed a few inches to a foot thick has been found in a few places above this member.

The "West Franklin" limestone, like the "Shoal Creek" limestone, has relatively high resistivity and so can be sharply differentiated in electric logs from beds above and below. It produces what is usually the most conspicuous peak in the normal curve between the "Shoal Creek" and the Herrin limestone which forms the caprock of No. 6 coal bed.

"No. 7" coal bed.—A thin coal bed which is tentatively designated "No. 7" is the first coal bed above the No. 6 bed. The relationship is similar to that of No. 7 and No. 6 beds in the northern part of the State (Peoria, La Salle, and possibly Vermilion counties), but whether this bed in Wayne County is actually at the same stratigraphic position as the Danville (No. 7) bed in Vermilion County remains to be established. This bed also has a position similar to that of the Cutler[4] coal in Randolph and Perry counties which has likewise been regarded as possibly representing the Danville (No. 7) coal bed. The "No. 7" coal bed in Wayne County lies 40 to 60 feet above the No. 6 bed and 125 to 175 feet below the "West Franklin" limestone. The beds intervening between the "West Franklin" limestone and "No. 7" coal bed consist mainly of shale and sandstone, with the former predominating.

3 Collett, J., Indiana Dept. Geol. & Nat. Hist. 13th Ann. Rept., pp. 61-62, 1884.

4 Bell, A. H., Ball, C. G., and McCabe, Louis, Geology of the Pinckneyville and Jamestown areas, Perry County, Illinois: Illinois Geol. Survey, Illinois Petroleum 19, p. 3, 1931.

The maximum thickness of the "No. 7" coal bed appears to be about 3 feet. That the bed is generally less than 6 feet thick is inferred from the fact that in most electric logs the "third curve No. 2" (which is usually made with an electrode 71 inches long) shows a deflection to the left at the position of the coal bed (see discussion p. 17). However, the best basis for estimating the general thickness of the bed is the information obtained from time-logging and study of cuttings, and it is primarily upon this basis that the estimate of a maximum thickness of 3 feet is made. It is probable that this bed is usually of less than workable thickness, but it is persistent and is therefore a good stratigraphic marker and an aid in identifying the No. 6 coal bed. The position of the bed is usually marked by a slight "peak" (indicative of increased resistivity) on the normal curve as well as by the deflection in the "third" curve noted above.

No. 6 coal bed.—The No. 6 coal bed is the thickest—although not the most widespread—coal bed, at least in the Carbondale and McLeansboro groups in Wayne County. The average thickness of the bed, estimated by the senior author from available information that consists mainly of the data supplied by electric logs, is about 4 feet. In many holes the coal bed appears to be less than 2 feet thick (fig. 10), in some holes more than 5 feet are believed to have been penetrated, and in some parts of the county the bed seems to be missing. As stated, generalizations in regard to thickness of beds based upon information very largely gathered from electric logs should be evaluated with due regard to the source of the information. It should be pointed out in this case, however, that time-logging indicates that the coal bed is locally as much as 5 feet thick (see tabulations—County Nos. 397, 401, 408, and 409).

Herrin limestone is usually present as a caprock above the No. 6 coal bed. It has a distinctive lithology and is readily recognizable in drill-cuttings as an impure, earthy, dark-gray to bluish-black limestone, finely granular or sugary, and somewhat fossiliferous. This member does not invariably display typical characteristics but color and texture when typically displayed are fairly unique among Pennsylvanian limestones. Among characteristic fossils sometimes seen in the cuttings are fragments of certain fairly large robust fusulinids (*Fusulina girtyi* (Dunbar and Condra).[5] This form, however, is not restricted to the Herrin limestone but is probably not found far above No. 7 nor far below No. 5 coal beds.

The Herrin limestone and No. 6 coal bed produce a more or less combined high resistivity "peak" in the normal curve of the electric logs. In a good many logs a break in the curve may be observed which can be interpreted as indicating the presence of a bed of shale intervening between the limestone and the coal bed, but it should be pointed out that other evidence does not always substantiate this interpretation (pl. 1, column nos. 1, 2, 3, 4, 6, and 7). When such a break in the resistivity curve takes place, whether for the reason stated or for some other cause, the second "peak" is usually less prominent than the one which is believed to represent the position of the limestone bed. The pattern of the "third curve No. 2" across the position of the coal bed is highly varied so that a generalization is not possible.

No. 5 coal bed.—The No. 5 coal bed lies 60 to 100 feet below the No. 6 bed. In holes where drilling-time observations have been made, No. 5 bed was found to be 3 to 5 feet thick (fig. 11). In most such wells the coal bed has no caprock, or if such a limestone is present, it is thin. It has generally been found that for some unknown reason the No. 5 coal bed drills somewhat more slowly than the No. 6.

Although No. 5 coal bed does not have a caprock, its position is usually fairly definitely indicated by a well pronounced "peak" in the normal curve indicating relatively high resistivity as compared with beds for a few feet above and below (pl. 1).

This coal bed seems to be somewhat more continuous than No. 6 coal in Wayne County (fig. 11).

[5] Dunbar, Carl O., and Henbest, Lloyd G., Pennsylvanian Fusulinidae of Illinois: Illinois Geol. Survey Bull. 67, pp. 115-117, 1942.

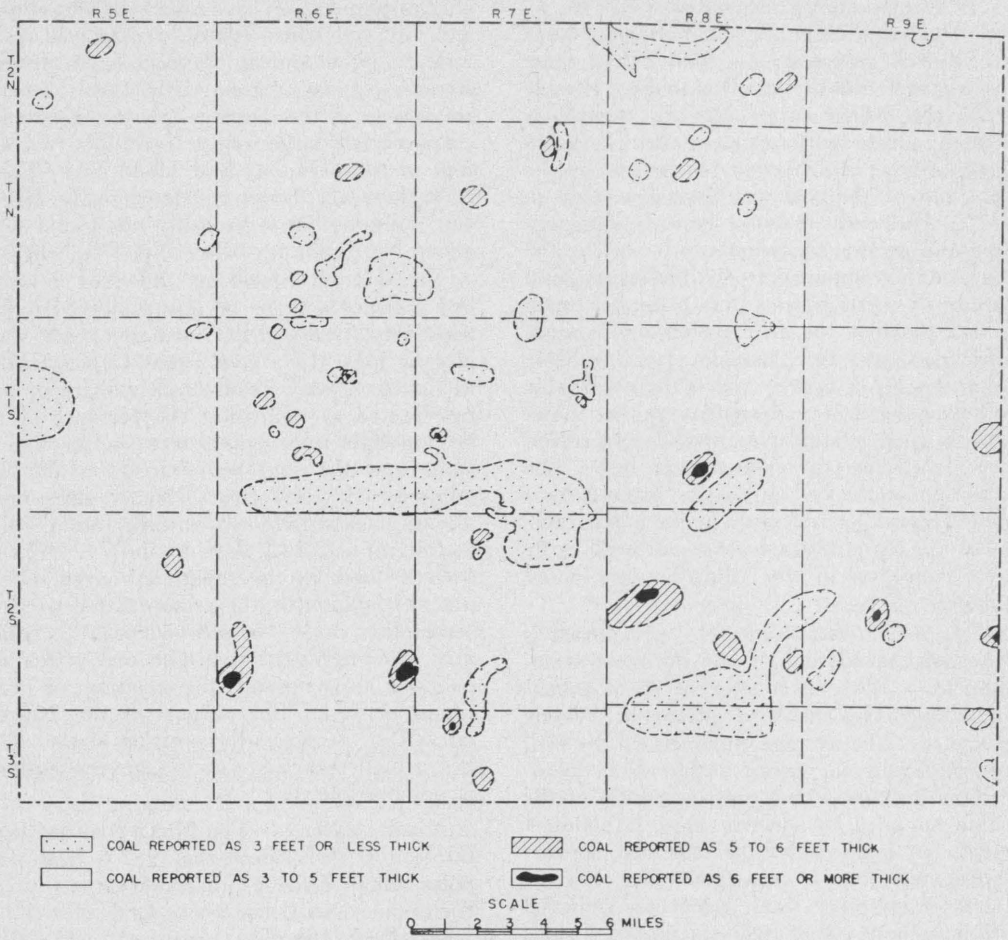


FIG. 10.—Thickness of Herrin (No. 6) coal bed in Wayne County.

STRUCTURE MAPS

USE OF STRUCTURE MAPS IN SEALING DRILL HOLES

The two structure maps accompanying this report (pls. 4 and 5) were prepared in order to provide a generalized picture of the approximate position and "lay" of the two coal beds Nos. 5 and 6 which are probably the most important coal beds underlying the county. In order that the use of the structure maps, particularly that of the No. 6 coal bed, may be understood by those responsible for the protection of the coal beds, a brief explanation is presented.

Structure of No. 6 coal bed.—The contour lines on the map of No. 6 coal bed represent the position of points of the same altitude on the top of the No. 6 coal bed, at intervals of 25 feet. It will be noted that in this particular map all lines designate distances below sea level, the coal at all points in the county lying below sea level. When a particular position represented by a drill-hole to be plugged is situated on a contour line, the top of the coal bed lies at the distance below sea level indicated by that contour line. The contour line does not give the depth to the coal bed; this figure is determined by adding to the surface elevation the figure on the contour line. For points situated between contour lines, the depth of the coal bed below sea level can be roughly estimated in accordance with the relative position of the

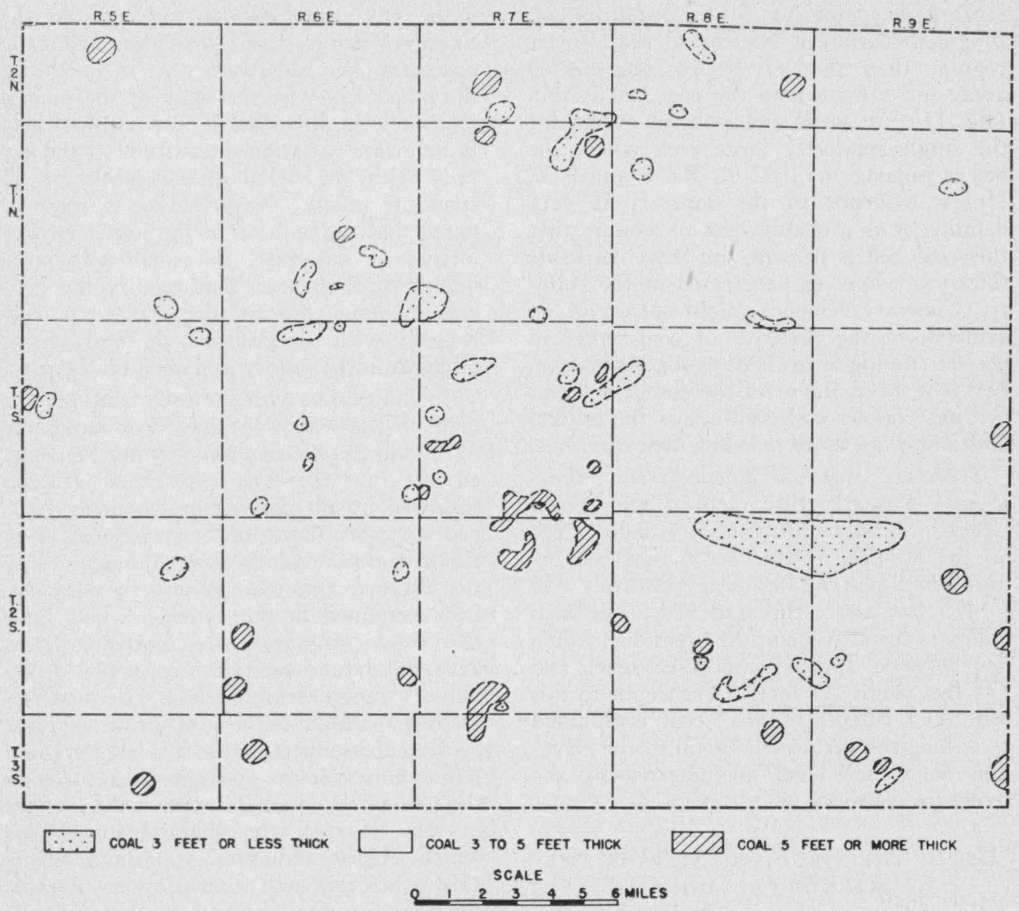


FIG. 11.—Thickness of Harrisburg (No. 5) coal bed in Wayne County.

point in question between the two adjacent contour lines, but it is usually accurate enough to use the nearest contour line. Thus, take for example drill-hole at County No. 165 (sec. No. 30, T. 2 S., R. 6 E.) is situated close to contour -575, hence No. 6 coal bed lies approximately 575 feet below sea level. The surface altitude or point of measurement has an altitude of 429 feet above sea level, hence the top of the coal bed is at a depth of 1004 feet.

To protect this coal bed properly the plug should extend from a depth of 954 feet to 1059 feet (assuming that the bed is 5 feet thick) that is from 50 feet above to 50 feet below the coal bed. However, there is also No. 5 bed to be protected, and since this bed is rarely more than 100 feet below coal No. 6, the top of the plug placed to protect this bed will coincide with the bottom of the plug that protects No. 6 bed. Hence, to protect both beds the plug should extend from 50 feet above No. 6 (954 feet) to 50 feet below No. 5 (1164 feet), assuming that No. 5 bed is also 5 feet thick. If it can be determined that the No. 5 bed lies less than 100 feet below the No. 6 bed, the plug can be correspondingly shortened.

Areas in which No. 6 coal bed is absent. The available evidence (June, 1943) seems to indicate that the No. 6 coal bed is very thin or entirely absent in five areas in Wayne County (pl. 5 and fig. 10), where, accordingly, no protection is necessary for this bed. Drilling in the county is so spaced, however, that the areas may be more continuous than is indicated by the map, but the boundaries indicated on the map are drawn so as to include the areas in which the coal is at least probably absent.

Areas in which No. 5 coal bed is absent. The distribution of No. 5 coal bed is more regular than that of No. 6, and barren areas and areas where the coal bed is thin (fig. 11) are small and isolated except for the single relatively large area where the bed is missing in T. 2 S., Rs. 8 and 9 E. Unless evidence to the contrary is very definite, it is probably best to assume that this coal bed is present and is of workable thickness wherever penetrated in the county. Contrary evidence might consist of no evidence of the presence of coal either in the electric log or in the time-log based upon two-foot intervals, or of the absence of coal drilling samples collected across the critical position at not more than five-foot intervals.

Structure map of "Shoal Creek" limestone.—The structure map of the "Shoal Creek" limestone provides a rough check on the position of the No. 6 coal bed because the limestone lies quite uniformly 450 to 475 feet above this coal bed. The map indicates the altitude of the limestone, which lies between approximately sea level and 175 feet below sea level. The depth to this bed, like the depth to No. 6 coal, is obtained by adding the surface elevation to the elevation below sea level as indicated by the structure contours on the map.

Use of the Structure Maps in the Search for Oil and Gas

The structure maps serve a further useful purpose, which is important to those concerned with the development of the oil resources of the State, in identifying and mapping at least two widely distributed beds in the upper part of the Pennsylvanian succession. No doubt such use has previously been made of these strata in this region but mainly by those who have exceptional resources of information. Such maps are useful not only as a demonstration of the use of upper Pennsylvanian beds for this purpose, but taken together they show the lack of parallelism of the Pennsylvanian beds and the necessity of using more than one key bed in locating oil structures.

Both structure maps were prepared in the early part of 1943 and hence do not include information that has accumulated since about June of that year. Furthermore, only those records available to the Survey which contain information about the particular key beds were used in preparing the map. Likewise the scale of the map is relatively small so that it was impracticable to delineate variations in altitude of the key beds with the detail characteristic of oil structure maps. Nevertheless it may be noted that the position of the minor irregularities of structure, the small anticlines, domes, and terraces, that modify the general regional dip of the strata coincide roughly with the positions of most of the oil pools in the county as named on the map.

In connection with the use of the present maps in the search for structures favorable to oil and gas accumulation it may be pointed out that the long established practice followed by the Survey in preparing coal-bed structure maps has been adhered to in the preparation of the present map. Only the datum points mapped and the information contained in the tabulated lists have been used. Contours are plotted to pass between datum positions at points determined by engineering methods. Because this method permits little latitude to express geological interpretations, it is all the more remarkable that the positions of so many of the oil pools coincide with irregularities in the "lay" of the Pennsylvanian beds which suggest structural conditions favorable to oil and gas accumulation. This is the case in spite of the fact that the oil-bearing strata lies many hundreds of feet below the beds mapped. Reworking of the evidence on large scale maps by those skilled in the drafting of structure maps designed to delineate "oil structure," with the insertion of new data, would probably yield information even more useful. Nevertheless, it is thought that the present maps and the map of the Millersville limestone in an accompanying report, demonstrate the usefulness of certain Pennsylvanian key beds for delineating oil structures in deeper strata. It is quite possible that the beds selected may not be the ones showing closest parallelism with the oil-bearing horizons, but the selection was determined primarily for the purpose of locating the position of workable coal beds and not to delineate "oil structures" in beds of Mississippian and earlier age.

COAL RESOURCES BASED ON INFORMATION OBTAINED FROM ROTARY DRILLING

February 1, 1942 to May 31, 1943

BY

GILBERT H. CADY

COMPILATIONS BY EARLE F. TAYLOR

WORKABLE COAL beds are defined[1] as beds 30 inches or more thick at a depth of 1,000 feet or less and 36 inches or more thick at a depth of more than 1,000 feet.

Although Pennsylvanian beds extend continuously across the the Illinois basin, it has commonly been thought that workable beds were generally lacking or were very thin in the central part of the basin where most of the oil has been discovered since 1936. Mining operations on the basinward side of the southern Illinois coal-mining districts have found beds thinner and the coal less desirable than the coal from the main mining districts in central, southern, and southwestern Illinois. Such marginal mining operations have been located at Norris City in White County, Mt. Vernon in Jefferson County, Kinmundy and Salem in Marion County, Lovington in Moultrie County, and Mattoon in Coles County. A little exploratory work has been done in southern Hamilton and the eastern parts of Crawford and Lawrence counties within a few miles of Wabash River, but no shafts have been sunk nor diamond drill-holes bored in search for coal over a large area in Hamilton, northern White, Wayne, Edwards, Wabash, Lawrence, Richland, Clay, Crawford, Jasper, Effingham, Clark, and Cumberland counties.

The systematic logging of Pennsylvanian strata by observing drilling-time and studying cuttings by methods described elsewhere in this report (pp. 9-21) provided detailed logs of 140 drill-holes by the end of May 1943, most of which were located within the central part of the Illinois basin where previous information was indefinite and generally unsatisfactory (fig. 12). At the start of the investigation in February 1942, the possible position of the Herrin (No. 6) coal bed could be only roughly estimated within the central part of the basin. Whether or not this bed was actually present was largely unknown. Consequently at the time the Conservation Act was put into effect this general area was designated as a region probably barren of workable coal beds, "where there is no definite evidence of the presence of workable coal beds, but where there is some chance that further drilling may encounter evidence of the presence of such coal beds."[2]

Because of the discovery of numerous workable beds in the central part of the basin resulting from these studies and the identification of what is believed to be the Herrin (No. 6) coal bed in a number of these counties, the original map[3] showing the distribution of drill-holes of various type categories was revised December 1, 1942, by considerably reducing the area in which "Type B" drill-holes may be located and enlarging the "Type C" area ("Wells located in regions where workable coal is probably present but depth and thickness are not certain"). This revision also showed the approximate altitude of Herrin (No. 6) coal bed within a large area of the basin by structure contours at 50-foot intervals. The area in which "Type B" wells could be drilled was reduced to part of Moultrie County, part of Shelby County, and Effingham, Jasper, Cumberland, and Coles counties. Additional information obtained between December 1942 and May 1943 will make further reduction of the "Type B"

1 Oil, Gas, and Coal Conservation Act—Rules and Regulations. Rule P-1 Plugging of Wells, E. 4, p. 14. Illinois Dept. of Mines and Minerals, Division of Oil and Gas Conservation, July 29, 1941.

2 Oil, Gas, and Coal Conservation Act—Rules and Regulations, op. cit., p. 8. Rule C-2, Type B.

3 Taylor, E. F., and Cady, G. H., Map of the State of Illinois showing Areal Type Classification for Wells in the Illinois Coal Basin: Illinois Geol. Survey Circ. 85, May 1, 1942.

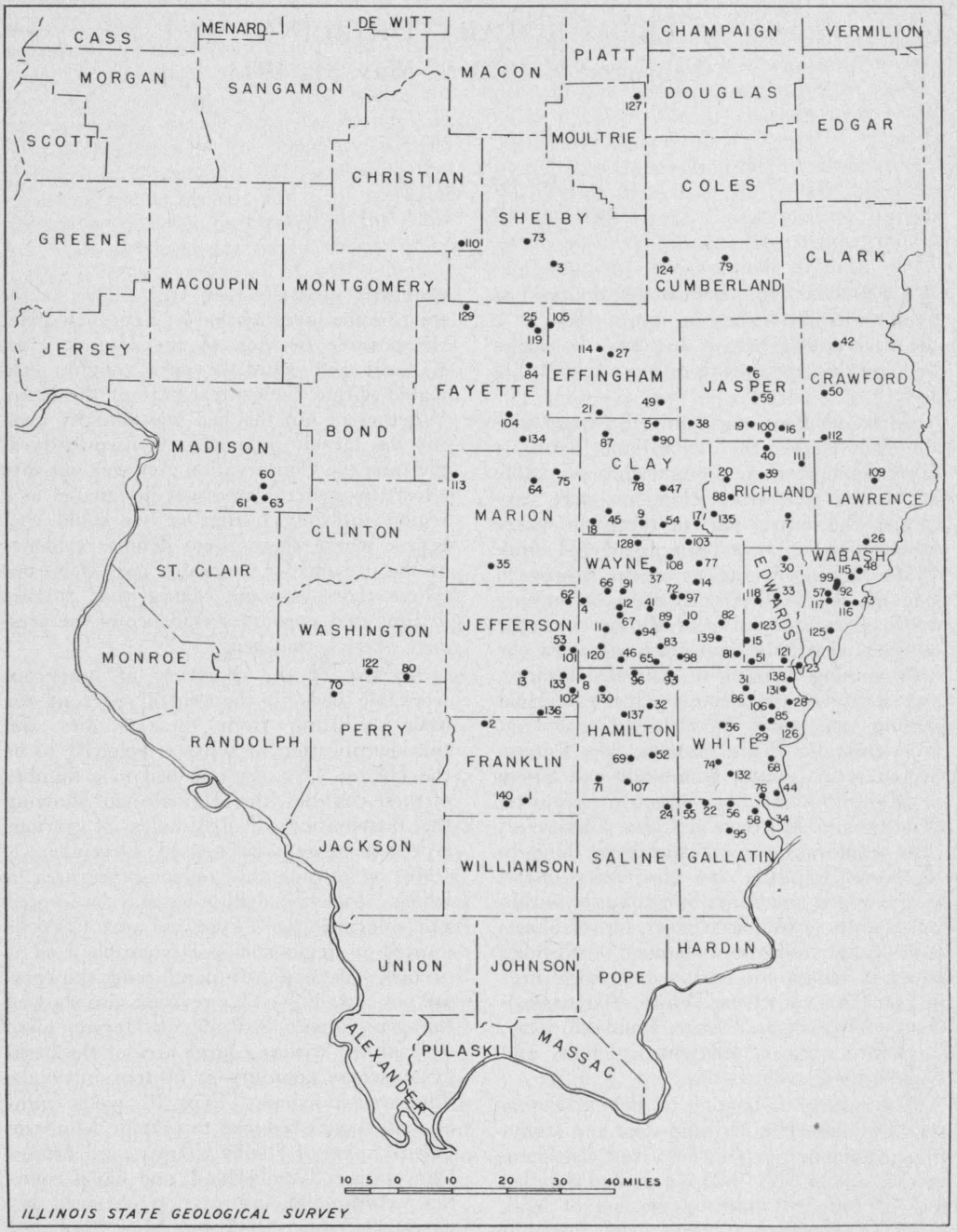


FIG. 12.—Map showing location of rotary-drill holes studied in the field.

area possible, practically eliminating it from the central part of the basin which will be shown as "Type C" area.

The present investigation has resulted not only in the discovery of workable coal beds in individual drill-holes but in providing considerable information about the thickness and distribution of these beds and a resulting increase in the inventory of potential reserves by a very substantial amount.

The methods used to identify the various beds encountered in the drill-holes and the determination of their thicknesses are described on pp. 9 to 21, but it should be realized that these methods can not provide precise data such as are obtained by core drilling. Using the records compiled from time-logs and study of drill-cuttings, electric logs of the Pennsylvanian succession in adjacent holes can be interpreted with reasonable accuracy, as explained and illustrated more fully on the pages noted above. Important coal beds and certain key limestone members can usually be located in individual logs by this method.

County Tally of Results of Drilling Observations

The accompanying tables (tables 1 and 2) present in summary form the information assembled up to May 31, 1943, with regard to the location and identification of the drill-holes logged and the depth, altitude, and thickness of workable coal beds. Table 2 also shows the character of the material above and below each coal bed recorded. The first stratum listed is the highest and the last is the lowest. Where correlations can be made with reasonable probability of accuracy these are indicated.

This information will be of assistance in identifying the position of the important coal beds in the Illinois basin, both in driller's and in electric logs. Many of the electric logs of the wells that have been logged by the Survey are available to operators and inspectors, and the data provided in the accompanying tables 1 and 2 will make it possible to determine the position of the coal beds in those records. The characteristic pattern produced by coal beds and associated limestones in the electric log of one such well can usually be recognized in the electric logs of adjacent wells. Usually the position of each of the coal beds No. 7, No. 6, and No. 5 is at a fairly regular distance below a prominent limestone, such as the "West Franklin," the "Shoal Creek," or the Millersville (pp. ___). Although the pattern of the electric logs does not provide definite information about the thickness of the coal beds recorded nor absolute evidence that coal rather than just underclay is present at the coal bed horizon, the occurrence of coal in one hole that has been carefully logged may well be accepted as evidence that coal is probably present in adjacent holes so far as the characteristic pattern is maintained.

Certain counties, such as Madison, Perry, Saline, and Washington, lie within the parts of the basin where the distribution of the coal beds is well known, and the results of drilling observations are not of particular interest for purposes of this report. The counties which lie within the central part of the basin or on the east side of the La-Salle anticline will receive special attention, namely: Clay, Crawford, Cumberland, Edwards, Effingham, Fayette, Gallatin, Hamilton, Jasper, Jefferson (north half), Lawrence, Marion (east part), Moultrie, Richland, Wabash, Wayne, and White counties.

The location of the 140 wells observed between February 1, 1942, and May 31, 1943, is shown on figure 12. The numbers accompanying each correspond to the map numbers in tables 1 and 2.

Clay County

Ten drill-holes, fairly well distributed, have been logged in Clay County. Eight of the holes logged penetrated coal 3 feet or more thick. A coal bed believed to be Herrin (No. 6) lies at depths between 962 and 1054 feet (altitude 448 and 511 feet below sea level). This coal bed varies about 130 feet in altitude within the county (448 to 580 feet below sea level), dipping in general toward the east. However, in the southeast part of T. 3 N., R. 5 E. the bed has an altitude higher than elsewhere in the county except in T. 5 N., R. 5 E. It seems probable that this coal bed is generally present in the county and that it maintains a thickness of at least 4 feet.

Another coal bed, probably Harrisburg (No. 5) bed, also with an average thickness of about 4 feet, is present in some holes

60 to 75 feet below the No. 6 bed. Assuming that a total of 4 feet of coal is present in both of these beds within the entire area of the county of 462 square miles, the total coal resources amount to nearly 2 billion tons, at the rate of 1 million tons per square mile per foot of coal.

In addition, some holes penetrated a 3- to 4-foot coal bed, possibly the equivalent of the Danville (No. 7) coal bed, 25 to 50 feet above the Herrin (No. 6) bed. The three beds—No. 7, No. 6, and No. 5—lie fairly close together near the base of the McLeansboro group and in the upper part of the Carbondale group.

In general logging did not continue to a sufficient depth below the Harrisburg (No. 5) bed to determine whether or not lower beds found in adjacent counties (Richland and Wayne) are also present in Clay County.

The depth of the productive zone containing beds No. 7, No. 6, and No. 5, ranges between 950 and 1050 feet. Some of the wells logged penetrated beds reported as 3 to 4 feet thick several hundred feet above No. 6 coal bed, but such beds seem to be more local in distribution than any of the lower group of coal beds, and no attempt has been made to estimate the quantity of such coal.

Crawford County

Three drill-holes have been logged in Crawford County, all in R. 13 W. in the west half of the county within or adjacent to the main oil pools that have been operating for many years. The results of the logging are remarkable in the number of workable coal beds found in each of the three holes above a depth of 900 feet. Definite correlation of the coal beds with the commonly known beds of the Illinois succession is impossible, but it seems probable that the coal bed which in the northwest part of the county lies at an altitude of about 40 to 50 feet above sea level represents the Herrin (No. 6) coal bed. It is reported as 4 feet thick in one locality and 6 feet in another. The depth of this bed ranges between 431 feet in one hole and 544 feet in another. Other coal beds varying from 3 to 8 feet in thickness are reported to a depth of 880 feet.

It is apparent from the results of logging of these holes that the oil development in Crawford County was carried on in a region where several workable coal beds are present and that greater care than has been exercised in the past should be taken in locating and measuring these beds when wells are drilled. Unfortunately the amount of new drilling in Crawford County has been relatively small in 1942 and 1943, and the opportunities for logging the Pennsylvanian succession have been correspondingly few.

The presence of workable coal beds in the east part of Crawford County is shown by records in the Survey files of what is believed to be core-drilling in T. 7 N., R. 11 W., in which three to six beds of coal are reported to be from 3 to 8½ feet thick. Probably these represent some of the beds worked in Sullivan County, Indiana.

From the information available it seems probable that this county contains a large reserve of workable coal lying less than 800 feet below the surface with beds possibly up to 6 feet thick at a depth of not more than 550 feet. The quantity of the coal reserve is probably in the order of at least 2 billion tons in beds 4 feet or more thick. Difficulty in mining in the closely drilled areas will probably reduce the recoverable quantity by a very considerable amount unless special methods of recovery such as underground gasification not requiring underground mining of the coal itself are employed, a not entirely remote possibility.

Cumberland County

By the end of May 1943 only two holes had been logged in Cumberland County by the Survey field parties. Only one showed more than 3 feet of coal and this was a 4-foot bed between 1050 and 1100 feet, or 467 feet below sea level. Observation at neither drill-hole continued to the full thickness of the Pennsylvanian system which is probably 1600 to 1800 feet thick. Although there is inadequate evidence of the presence of important coal resources in the county, observations to greater depth may alter the picture at any time.

Edwards County

Seven holes have been logged in Edwards County. All penetrated coal beds 3 feet or

more in thickness. A bed thought to be Herrin (No. 6) was penetrated at an altitude of about 400 feet below sea level on the east side of the county and about 100 to 125 feet lower on the west side. The depth to this bed ranges between 850 and 975 or possibly 1025 feet. The bed is reported as 4 to 5 feet thick and apparently is widespread.

Harrisburg (No. 5) bed ranging between 3½ and 4 feet in thickness, seems to be present usually at 75 to 100 feet below the Herrin (No. 6) bed, and a third persistent coal bed lies about 300 feet below No. 6 (well No. 118 at 1289 feet and No. 33 at 1270 feet). The correlation of this lower bed with other coal beds in Illinois is speculative. The DeKoven and Davis beds of southern Illinois lie at about this distance below Herrin (No. 6) bed.

Edwards County, with an area of 238 square miles, is probably underlain by as much as a total of 5 feet of coal in two beds and hence possesses a reserve supply in the order of 1.2 billion tons of coal of minable thickness. Some will probably be rendered unrecoverable because of encroachment of water and gas from inadequately sealed drill-holes and abandoned oil wells. This is the case in all the counties considered.

Effingham County

Of the 5 holes that have been logged in Effingham County only one failed to penetrate at least one coal bed of workable thickness. The eastward dip of the strata produces a variation in the altitude of the Herrin (No. 6) bed from 150 feet below sea level near the northeast corner of the county to 600 feet below sea level in the southeast corner where the bed nearly reaches its lowest altitude in the State. This bed seems to be of workable thickness (4 to 5 feet) only in the southern part of the county. In well No. 49 another 5-foot bed, possibly Harrisburg (No. 5), was penetrated about 40 feet below No. 6. Only one of the wells was logged to a depth greater than 1100 feet. The depth to Herrin (No. 6) coal bed ranges between about 800 feet on the west and about 1150 feet on the east side of the county.

Assuming that only the southern half of the county is underlain by workable coal and that 4 feet of coal are present, the reserve amounts to about 1 billion tons of coal for an area of about 250 square miles.

Fayette County

Coal beds 3 feet or more thick were found in all six holes logged in Fayette County. The Herrin (No. 6) is believed to have been penetrated at all but two localities, both of which are at the north end of Louden pool (No. 25 and No. 119). This bed is known to be present in the west part of Fayette County northeast of Vandalia but is regarded as thin and unworkable, if present, between Vandalia and the south line of the county.[4] All holes but one of those logged were located in the east half of the county; No. 129 was located in the northwest corner.

It is probable that everywhere in this county east of R. 1 E. the Herrin (No. 6) coal bed is thinner than it is in the west tier of townships north of Vandalia, probably varying from 3 to 5 feet in thickness. The recoverable coal of this county occurs in beds which probably do not average more than 4 feet in thickness for the entire county. The previous estimate by Kay of nearly 4 billion tons for Fayette County (729 square miles) is probably approximately correct.

Gallatin County

In Gallatin County the information concerns particularly the north part of the county, in Ts. 7-9., Rs. 8-10 E., between New Haven on the north and Shawneetown on the south. Until recently drilled, very little was known about the occurrence and "lay" of the coal in this area,[5] yet the presence of several beds of coal was believed probable because of the presence of such beds in surrounding better known areas.

The information supplied by the logging of five drill-holes by Survey field parties indicates that the structure of the Pennsylvanian system in Gallatin County is very irregular. Consequently the "lay" of the coal beds is very uneven and depths are varied. The tabulations show a variation in altitude of Herrin (No. 6) coal bed

4 Kay, F. H., Coal Resources of District VII (Southwestern Illinois): Illinois Geol. Survey Coop. Mining Ser. Bull. 11, pl. I, 1915; reprinted 1922.

5 Cady, G. H., Structure of Herrin (No. 6) coal bed in Hamilton, White, Saline, and Gallatin counties, Illinois, north of the Shawneetown fault: Illinois Geol. Survey Cir. 42, Structure map, May 1, 1939.

ranging between 38 feet above and 275 feet below sea level within a distance of not more than 10 miles in the northeast part of the county, and a corresponding variation in depth between 315 and 685 feet. The thickness of No. 6 coal bed ranges between 5 and 7 feet but is generally reported as 5 feet, which is about the usual thickness in exposures and mines in the southern part of the county. Harrisburg (No. 5) bed was also usually recorded, when the hole was logged to a sufficient depth, about 100 feet below the No. 6 bed. It likewise is about 5 feet thick. Other, but usually thinner beds, are also probably present: Hole No. 56 penetrated a coal bed about 100 feet below the Harrisburg (No. 5) bed, and hole No. 34 found a 3-foot bed about 215 feet below No. 5. Outcrops and records of diamond-drilling in areas adjacent to the west and south indicate that beds are present elsewhere at about these intervals below No. 5 bed. The bed 215 feet below No. 5 (depth 682 feet) is probably the DeKoven or "3-foot" coal of western Kentucky which has also been mined near Stonefort in southeastern Williamson County. This bed lies 215 feet below Harrisburg (No. 5) and 315 feet below Herrin (No. 6) coal bed where penetrated by core-drilling near New Haven.[6] The DeKoven coal bed is commonly associated with the Davis or "4-foot" bed which at hole No. 34 lies 27 feet below the top of the bed correlated with the DeKoven. The Davis is the more continuous of the two coal beds.

The writer has previously estimated the amount of coal in No. 6 and No. 5 coal beds in 225 out of 338 square miles of Gallatin County as about 2 billion tons.[7] This estimate is exclusive of the considerable quantity of coal present in the area known as Eagle Valley in southern Gallatin County and of the coal present in the Davis and DeKoven beds. The latter two beds probably contain in the order of 1 billion tons of coal in the 225 square miles underlain by Harrisburg (No. 5) bed north of Eagle Valley.

Hamilton County

The structure of Herrin (No. 6) coal bed in the south part of Hamilton County has been previously mapped using data revealed by diamond-drill-holes[8] and a few holes drilled by cable-tools. The present discussion concerns mainly the coal resources in the north part of the county (Ts. 3 and 4 S.), although observations were made on four holes in T. 6 S. across the south part of the county in order to check previous somewhat questionable determinations.

Except for a single hole located along the north line of the county (No. 96), the Herrin (No. 6) coal bed is believed to have been penetrated at all localities where observations were made, and Harrisburg (No. 5) bed was penetrated in all but three. The upper bed ranges between 4 and 6 feet and probably averages about 4½ to 5 feet in thickness; the No. 5 bed is somewhat thinner, probably not over 4 feet.

In general the strata in Hamilton County dip northward, with one prominent dome-like irregularity, the "Dale Dome," in the south-central part of the county. No. 6 bed lies about the same distance from the surface in the well located on the "dome" and in one located several miles south near the south line of the county (hole No. 69—642 feet, No. 107—646 feet). This bed has a depth of 1001 feet at its lowest recorded altitude of 589 feet below sea level about three miles north of McLeansboro (hole No. 137).

This county, with an area of 455 square miles, is undoubtedly underlain by an average thickness of 8 feet of coal represented by the two beds, Herrin (No. 6) and Harrisburg (No. 5). This represents a total of about 3½ billion tons. Since there is information about lower beds from only one drill-hole, no estimate is made of the quantity of coal present below the No. 5 bed. In this hole (No. 52) what is probably the DeKoven ("3-foot") bed was found at a depth of 994 feet about 240 feet below the Harrisburg (No. 5) bed, 4½ feet being recorded. Additional logging of the lower part of the Pennsylvanian system is necessary to prove the extent of this lower bed and the possible presence of other beds, particularly the Davis ("4-foot") bed.

6 Cady, G. H., Coal Resources of District V (Saline-Gallatin counties): Illinois Geol. Survey Coop. Mining Ser. Bull. 19, pl. II (p. 18), columnar section No. 8, 1919.

7 Cady, G. H., op. cit. Table 15, p. 106.

8 Cady, G. H., Structure of Herrin (No. 6) coal bed in Hamilton, White, Saline, and Gallatin counties, Illinois, north of the Shawneetown fault: Illinois Geol. Survey Cir. 42, Structure map and tabulated data, May 1, 1939.

Jasper County

Jasper County overlies the deepest portion of the Pennsylvanian basin. The Herrin (No. 6) coal bed varies in altitude from 450-500 feet to 600-650 feet below sea level. The trough of the basin in which the coal bed lies more than 600 feet below sea level is a narrow area elongated in a northeast-southwest direction in the western part of the county.

Seven drill-holes have been logged in Jasper County, all but one in the south half of the county. The coal bed thought to be Herrin (No. 6) lies at depths ranging between 1100 and 1200 feet in the trough of the basin, its shallowest recorded depth in the county being 988 feet in the southeast part of the county (No. 51). Correlation of the coal beds is imperfectly established and should be regarded as tentative. At one place (hole No. 6) in the north half of the county two coal beds 3 and 4 feet thick separated by about 10 feet of clay and limestone may represent a "split" phase of No. 6 bed, but there are, of course, several other possibilities. The bed at 1181 feet in hole No. 38 is probably Harrisburg (No. 5) if the one at 1138 is No. 6.

In general the coal beds penetrated in the holes drilled in this county are 4 feet or less thick, although a coal 6 feet thick is recorded in one log (No. 19). The full thickness of the Pennsylvanian system has not been logged in Jasper County, and the occurrence of coal beds below Harrisburg (No. 5) bed has not been determined.

On the assumption that an average of 4 feet of coal in two beds is present, Jasper County, with an area of 508 square miles, contains in the order of 2 billion tons of coal of minable thickness.

Jefferson County

The coal resources of Jefferson County were described and estimated in 1916,[9] and a map showing the structure of Herrin (No. 6) coal bed in all but the northern tier of townships was distributed in 1938.[10]

9 Cady, G. H., Coal resources of District VI: Illinois Geol. Survey Coal Mining Inv. Bull. 15, p. 90, 1916.

10 Cady, G. H., Benson, T. E., Taylor, E. F., et al., Structure map of Herrin (No. 6) coal bed in central and southern Jefferson, southeastern Washington, Franklin, Williamson, Jackson, and eastern Perry counties, Ill.: Illinois Geol. Survey Circ. 24, blue-line print structure map and tabulated data, March 14, 1938.

Seven drill-holes have been logged by the Survey in Jefferson County. All but one were located in the less well-known north and northeast parts of the county. Special logging was required for hole No. 13 because it was located on State property. This is the only hole which was logged to a sufficient depth to penetrate either the DeKoven or the Davis coal bed (1075 feet), where only one bed of workable thickness was found.

In general the depths to No. 6 coal bed as determined by logging agree fairly closely with the altitudes shown on the structure map in Circular 24[10] and permit the extension of mapping somewhat beyond the limits of previous mapping. Herrin (No. 6) coal bed is reported as from 4 to 6 feet thick and the Harrisburg (No. 5) bed as from 3 to 6 feet thick.

The previous estimate of the amount of coal in Jefferson County was based upon the assumption that the south half of the county (283.7 square miles) was underlain by No. 6 coal bed with an average thickness of 6.2 feet and that this bed had an average thickness of only 4¾ feet in the north half of the county (283.5 square miles). There is no good reason for modifying the 1916 estimated reserve in No. 6 bed as approximately 3½ billion tons. In addition, however, it seems probable that the county is also underlain by No. 5 coal bed with an average thickness of at least 3 feet, providing a reserve of approximately 2 billion tons, making a total for the two beds for the county of 5½ billion tons.

There has not been enough exploration of the beds below Harrisburg (No. 5) to justify an estimate of the reserve represented by such beds. Mention has already been made of the lower coal (DeKoven or Davis ?) penetrated in hole No. 13 located on State property.

Lawrence County

Only two holes have been logged by the Survey field parties in Lawrence County, and they are so far apart that correlation of the coal beds penetrated at the two localities has not been attempted. Four coal beds each 2½ feet or more thick were reported for each hole, but it is not known whether or not any of the beds are continuous between the two localities. The

records of numerous churn-drill holes at various locations in this county, drilled in the past 40 years, report coal beds at various levels, and diamond-drilling in the east part of the county near Wabash County indicates that considerable quantities of coal in beds probably 3 or more feet thick are present at depths less than 1,000 feet. Because of the structural irregularities in the county, good records of fairly closely spaced holes are necessary for satisfactory correlation of the coal beds, and this requirement has not been met. Although it seems probable that a large reserve of coal is present in this county, the information available does not yet justify an estimate of its quantity.

Marion County

Only the westernmost fourth of Marion County (R. 1 E.) is underlain by Herrin (No. 6) coal bed with a prevailing thickness of 6 feet or more. This coal bed has been extensively mined near Centralia and as far east as Odin, but early attempts at mining at Salem and Kinmundy[11] were not particularly successful. The mine at Kinmundy, opened before 1890, was abandoned in 1908, and the mine at Salem which was opened about the same time was worked until 1905. At each mine the coal bed is reported as 4 feet thick.[12] At Salem the coal bed lies at a depth of 890 feet and at Kinmundy 863 feet. There are two benches of coal at Kinmundy, the upper 3-foot bench is separated from the lower 4-foot bench by 3 feet of shale and 5 feet of limestone. It is not certain that either bed is No. 6, but it is generally assumed that the lower bed beneath the limestone at a depth of 874 feet is the No. 6 bed.

Four holes have been logged in Marion County. Two are located in the northeast part of the county, each within about five miles of Kinmundy (Nos. 64 and 75), and each penetrated 4 feet of coal at a depth of 836 feet (272 feet below sea level at the south end of the Salem oil pool). It seems probable also that No. 5 coal bed is generally present 50 to 75 feet below No. 6 and that it is probably not more than 3 feet thick.

In 1915 the amount of coal present in the No. 6 bed in Marion County (569 square miles) was estimated as about 3 billion tons,[13] 1 billion being the quantity present in the west part of the county where the bed is 6 feet or more thick, and 2 billion tons in the rest of the county where the bed is about 4 feet thick. There is no reason for revising this estimate for No. 6 bed, but it seems probable that No. 5 bed is represented by 1½ billion tons of coal 3 feet or more in thickness, making a total of 4½ billion tons for both beds.

Hole No. 35 penetrated a coal bed recorded as 5 feet thick about 220 feet below the Herrin (No. 6) bed, which may be equivalent to the Davis or DeKoven bed, but logging of additional wells to several hundred feet below No. 5 bed will be necessary before the importance of lower coal beds can be evaluated.

Moultrie County

A coal bed 8 feet thick, regarded as the Herrin (No. 6) bed, was formerly mined at Lovington, Moultrie County, at a depth of 904 feet. Before the shaft was sunk two diamond-drill holes were drilled, one at and one near the position of the mine shaft. The logs of these holes were the only detailed records of the Pennsylvanian system available down to the No. 6 coal bed in Moultrie County before the drilling of hole No. 127 which was logged by members of the Survey staff. It is believed that No. 6 coal bed was missing in this hole and that No. 5 bed was reached at a depth of 1108 feet where its thickness was 4 feet. Mining at Lovington was confined to an area lying for the most part south of the shaft and it is suspected that the coal bed was unminable north of the shaft. It seems probable, on the basis of these data, that the No. 6 coal bed is not widespread in Moultrie County. Information about the occurrence and distribution of Harrisburg (No. 5) coal bed does not justify any estimate of the amount of coal present. The paucity of information makes it impossible to estimate the coal reserves in Moultrie County.

11 Geological Survey of Illinois, vol. VIII, p. 40, 1890.
12 Illinois Coal Reports, 1900-1907. Also notes on mine sampling for Kinmundy mine, Geol. Survey files.

13 Kay, F. H., Coal Resources of District VII (Southwestern Illinois): Illinois Geol. Survey Coop. Mining Ser. Bull. 11, p. 225, 1915; reprinted 1922.

Richland County

The coal resources of Richland County were essentially unknown before 1936. Seven holes have been logged in this county, all of which penetrated one or more coal beds reported as 3 feet or more thick.

In general the Herrin (No. 6) coal bed lies between 500 and 600 feet below sea level, being lower only in Jasper County to the north. The Herrin (No. 6) coal bed seems to be present in all holes logged and to vary in thickness from 4 to 5 feet. Its depth in general is between 1000 and 1100 feet, although in one hole it was found at 1107 and in another at 967 feet.

What is thought to be the Harrisburg (No. 5) bed generally lies between 50 and 75 feet below No. 6 bed and is usually 3 to 4 feet thick.

Hole No. 39 penetrated two beds of coal, the upper reported as 5 feet thick and the lower as 3 feet thick at 1435 and 1459 feet respectively, 404 and 428 feet below No. 6 bed. Although these may represent the DeKoven and Davis coal beds of Saline and Gallatin counties, the depth to coal No. 6 is somewhat greater than that usually observed. The only other drill-hole (No. 7) that was logged to 1500 feet revealed only the Herrin (No. 6) coal bed as more than 3 feet thick.

The holes logged are sufficiently well scattered over Richland County to indicate that No. 6 and No. 5 beds are probably widespread, the former having an average thickness of at least 4 feet and the latter of 3 feet. Assuming an average total thickness of 6 feet the 357 square miles of this county is underlain by approximately 2 billion tons of coal in these two beds. The coal beds about 400 feet below No. 6 must be further explored before any estimate of the reserve they represent is justified. It may be recalled that a deep-lying bed about 300 feet below No. 6 is also reported from Edwards County.

Wabash County

Coal has been mined for many years from shallow depths through slopes and shafts in the vicinity of Mt. Carmel in Wabash County. The coal bed that is mined is commonly known as the Friendsville bed, but some uncertainty exists as to whether the same bed was worked at all the mines that have operated in the county.

Herrin (No. 6) coal bed is believed to lie about 650 feet below the Friendsville coal bed. The Danville (No. 7 ?) coal bed about 50 feet above the Herrin (No. 6) bed is a persistent stratigraphic marker, as is likewise the limestone locally designated the "West Franklin" limestone about 200 feet above the Danville (No. 7) coal bed. A few feet above the "West Franklin" limestone is a thin coal horizon which is also usually found in the holes that have been logged. This lies about 250 feet above the Herrin (No. 6) coal bed and 400 feet below the Friendsville coal bed.

Six to eight coal beds other than the Friendsville are present in the outcropping upper portion of the Pennsylvanian system in the Mt. Carmel region, and locally one or two attain a thickness of about 2 feet, but the Friendsville bed seems to be the only one which is 3 feet or more thick over a considerable area. The extent of this area and the details of distribution of the Friendsville coal bed are being studied. This bed lies near enough to the surface at a number of places to be minable by open-cut methods.

Ten drill-holes that have been logged by the Survey field parties are fairly evenly distributed from north to south through the central part of the county. One of these holes (No. 117) was logged to a depth of only 70 feet 10 inches in order to obtain a record of strata lying near the surface; all the others were logged to or below the position of the Herrin (No. 6) coal bed. In them this bed varied in thickness from 3 to 5 feet, generally from 4 to 5 feet. The coal bed occurring about 50 feet above No. 6 bed and tentatively designated the Danville (No. 7) bed is generally about 1 foot less in thickness than No. 6. Harrisburg (No. 5) coal bed is believed to lie about 100 feet below No. 6 and has a usual thickness of 4 feet, but in one hole (No. 57) a thickness of 7 feet was recorded. In the same hole a coal bed 4 to 5 feet thick was encountered about 40 feet above the bed correlated with No. 5. Electric logs of other drill-holes in the county indicate that this bed is not widespread. It has apparently been penetrated in only one hole logged by the Survey field parties.

Details of the structure of Pennsylvanian beds in Wabash County are under special investigation preparatory to the publication of structure maps and drill-hole data, but in advance of such a report it may be stated that there are important irregularities with indications of some faulting in a north-south direction in the south part of the county; the faulting may continue southward, into Wabash County. In the west part of the county the Herrin (No. 6) coal bed lies from 200 to more than 375 feet below sea level, the general dip being westward, and the depth of the bed varies between 700 and 800 feet. In the east part of the county in the vicinity of and south of Mt. Carmel the No. 6 coal bed is found as high as only a few feet to a little over 100 feet below sea level and at depths varying from 400 to 575 feet.

Other coal beds are undoubtedly present below Harrisburg (No. 5) coal bed. One lying from 90 to possibly 150 feet below No. 5 is reported in three holes (Nos. 23, 43, and 48) as 3 to 4 feet thick, but it may contain a clay layer. There actually may be two coal beds, one about 100 and the other 150 feet below No. 5 (Nos. 23, 43) and others at still lower depths. Information at hand does not justify definite statements about the thickness and distribution of these lower beds.

Assuming that Herrin (No. 6) and Harrisburg (No. 5) beds have a total thickness of 8 feet, there is 1½ billion tons of coal in the 220 square miles of Wabash County. The coal in other beds, including the Friendsville bed lying near the surface, without much question increases this reserve to about 2 billion tons.

Wayne County

Wayne County is at the south end of the central trough of the Illinois basin. The full breadth of the county, except for a small area in the northwest part, extends across the portion of the basin where the Herrin (No. 6) coal bed lies between 500 and 600 feet below sea level, only very locally reaching below 600 feet. Here the structure of Pennsylvanian strata is relatively flat, nevertheless there is enough relief to mark the position of some of the oil-producing structures in the pre-Pennsylvanian strata.

Time-logging by the Survey has been applied to 26 holes drilled in Wayne County, so that the Pennsylvanian strata have been more thoroughly explored here than in any other county in the Illinois basin. The general structural features, stratigraphy, quality, and distribution of Herrin (No. 6) coal bed are discussed in the accompanying paper on "Pennsylvanian Key Beds of Wayne County," (pp. 27-32).

Although the Herrin (No. 6) coal bed is not present throughout the entire area of the county, the barren areas are relatively small. The Harrisburg (No. 5) coal bed appears to be more widespread than the higher bed and has about the same thickness. Assuming a total thickness of 7 feet for the two beds, and without consideration of the possible presence of lower beds, the resources of the county (733 square miles) is in the order of 5 billion tons.

The depth of the Herrin (No. 6) coal bed in this county is in general between 950 and 1050 feet; the Harrisburg (No. 5) coal bed is generally about 75 feet lower.

White County

Except for the south part of White County near Norris City, where the Herrin (No. 6) coal bed has been worked for many years, and except for a few diamond-drill holes at scattered locations in the south tier of townships, little dependable information in regard to the coal resources of White County was available prior to 1942. Since then 15 rotary-drill holes have been logged, two at least to depths between 1400 and 1500 feet.

One of the most complete records of the Pennsylvanian system in southeastern Illinois is provided by the record of a core-drilling in the vicinity of New Haven.[14] This well record has been useful in correlating and identifying beds encountered in the rotary-drill holes in southeastern White and northeastern Gallatin counties. (See "Methods of Subsurface Studies of the Pennsylvanian Strata Encountered in Rotary-drill Holes," this report, pp. 9 to 21.)

The structure of the Pennsylvanian system in White County is irregular. The

14 Cady, G. H., Coal Resources of District V (Saline and Gallatin counties): Illinois Geol. Survey Coop. Mining Ser. Bull. 19, pl. II, (p. 18), columnar section No. 8, 1919.

trough of the Illinois basin extends across Wayne County into the northwest quarter of White County where the altitude of the Herrin (No. 6) coal bed is more than 500 feet below sea level. On the east and south sides of White County, however, the coal bed rises to shallower depths and varies considerably in altitude within relatively short distances. Moreover the strata may be faulted. Faulting probably is the best explanation of the sharp difference in the altitude of Herrin (No. 6) bed in wells No. 138 (330 feet below sea level) and No. 131 (625 feet below sea level) in the northeast part of the county. Indications of faulting have also been discovered elsewhere in the east part of the county.

In the holes that have been logged Herrin (No. 6) coal bed varies in altitude from 58 to 625 feet below sea level (Nos. 36 and 131 respectively). The thickness of this bed varies from 3 to 8 feet in 13 out of 15 drill-holes, being less than 3 feet thick in 2 holes. The average thickness for the 15 drill-holes is a little more than 4 feet.

Harrisburg (No. 5) bed lies from about 75 to about 100 feet below coal No. 6, and in the 10 holes in which it was penetrated it averaged a little more than 4 feet in thickness. Four holes were not logged deep enough to reach No. 5 bed, and in only one hole was the coal less than workable thickness. This bed appears to be more widespread and regular than the Herrin (No. 6) bed.

The DeKoven bed about 200 feet below Harrisburg coal bed and the Davis bed 40 to 50 feet lower are reported in the records of some of the holes (Nos. 85, 29, and 31) but in places these beds appear to be cut out by sandstone. Where they are present they range between 3 and 4 feet in thickness.

About midway between the Harrisburg and DeKoven beds, and generally separated by about 50 feet of shaly and sandy strata, are two other fairly continuous coal beds. The upper one appears locally to be split into two benches separated by a shale parting; the lower one appears to contain no partings. For convenience in reference it is proposed to call the upper one No. 4 and the lower one No. 2, because they have the relative position of these two beds with reference to the Harrisburg (No. 5) bed. However, whether they are the exact equivalent of the Summum (No. 4) and the LaSalle (No. 2) of western and northern Illinois is not known, but it seems probable that they are not far from the stratigraphic positions of those beds. No. 2 or the lower bed is reported as 3 to 5 feet thick in five holes; the No. 4 or split bed does not appear to be more than 2½ feet thick. These two beds have also been encountered in some of the holes drilled in adjacent Wabash and Edwards counties.

In holes Nos. 44 and 126 the Davis and DeKoven beds did not seem to be represented, but a 4-foot and a 5-foot bed were encountered somewhat below the normal position for the Davis and DeKoven beds. Below the coal beds in each drill-hole a limestone several feet thick was penetrated. In southern Illinois two limestone beds, the Stonefort[15] and the Curlew limestone, both associated with coal beds, are known to be present. Most of the wells were not logged to a depth sufficient to reach the two deep coal beds found in holes Nos. 44 and 126.

The information available in regard to the coal beds in White County indicates that both Herrin (No. 6) and Harrisburg (No. 5) beds are generally present with a total average thickness of about 8 feet. Assuming that the 220 square miles of the county are underlain by these beds, the reserve (except for the small amount already mined at Norris City) amounts to about 1¾ billion tons.

Although lower beds are doubtless present in the county at the positions noted above, any estimate of their reserves of coal would be premature. There is little doubt, however, that the quantity is as much as one-quarter billion tons and that the total reserves of the county therefore are as much as 2 billion tons.

Summary of the Estimated Coal Resources in the Illinois Basin

The total resources in the counties in the Illinois basin and Crawford and Lawrence counties, not covered by previous estimates, are estimated as about 30.2 billion tons, distributed as follows:

[15] Henbest, L. G., Fusulinellas from the Stonefort limestone member of the Tradewater formation: Jour. Paleontology, vol. 12, pp. 70-85, 1928.

County	Square miles	Billion tons
Clay	462	2
Crawford	453	2
Cumberland	353	uncertain
Edwards	238	1.2
Effingham	511	1.5
Fayette	729	4
Gallatin	338	1[a]
Hamilton	455	2[b]
Jasper	508	2
Jefferson	603	2[c]
Lawrence	358	uncertain
Marion	569	1.5
Moultrie	338	uncertain
Richland	357	2
Wabash	220	2
Wayne	733	5
White	507	2
Total	7,732	30.2

[a] 2 billion additional by previous estimate.
[b] 3.5 billion additional by previous estimate.
[c] 3 billion additional by previous estimate.

This quantity of coal is about three times the quantity estimated to be present in No. 6 coal bed in Jefferson, Franklin, and Williamson counties, an area of 1182 square miles, and a little more than half the original tonnage estimated to be present in No. 6 bed in southwestern Illinois in an area of 6,978 square miles.[16]

Advisability of Core-Drill Exploration of the Coal Beds of the Illinois Basin

In view of the indications of large quantities of workable coal in the Illinois basin, the question will no doubt be raised as to the practical value of core-drilling to explore these resources more thoroughly. The coal beds of workable thickness include No. 6 bed and lower beds, all of which usually lie at depths between 900 feet and 1400 feet. In general the beds probably do not exceed 5 feet in thickness. Definite information about these coals awaits core-drilling, yet it would seem advisable, if drilling is to be done, that exploration be carried on in those inadequately explored portions of the main coal fields where beds 6 feet or more in thickness lie much nearer the surface than do the coal beds in the basin counties.

16 Kay, F. H., op. cit.

Quality of the Coal

One of the important considerations determining the value of coal is its chemical character. Coal-cuttings from the rotary drill-holes have supplied samples of coal from four places in the Illinois basin and one in Crawford County. Proximate values and values for sulphur and B.t.u. have been determined for each of these samples (table 1).

The sample cuttings, which were much mixed with clay and drilling mud, were washed in the laboratory, and the coal was separated from the loose mineral matter and clay by floating on a heavy liquid (specific gravity about 1.5). The samples were washed to remove the separating liquid and then dried at room temperature. It seems quite probable that the moisture of the coal as submitted to the chemical laboratory after this treatment was different and probably somewhat lower than the bed moisture, although there is no certainty that this was the case. The ash content of the samples as determined probably does not mean a great deal about the ash content of the various coal beds. It is not clear why several samples contain considerably more ash than others unless some of the coals are bony (C-2857 and 2858), but the coals may not have been equally well cleaned of clay and mud. In view of the treatment to which the coal samples were subjected, it seems probable that they all contain considerable finely disseminated pyrite. All of the coals from the basin show a relatively high unit coal value, about the same as that of No. 5 coal in Saline County. This may very well be the result of deep burial. The moist mineral-matter-free B.t.u. values would indicate relatively high rank if the sample represented standard face samples, but since they do not, this value does not have much significance. None of the coals is particularly low in sulphur. Discovery of an area of low-sulphur coal (1.25 per cent sulphur or less) would of course be a matter of much importance even if the bed lay 1000 feet or more in depth.

Significance of Coal Resource Studies

The coal beds of the Illinois basin are relatively thin as compared with the coal beds in the active mining districts, and they lie at greater depths generally exceeding 800 feet and commonly 1000 feet or more. Probably no effort will be made to exploit these resources while workable beds of greater thickness are available elsewhere at more shallow depths. Nevertheless it is important to have evidence of this tremendous reserve of solid fuel resources in a region where the existence of minable coal has generally been doubted.

The energy resources represented by the workable coal beds in most of these counties greatly exceeds the energy represented by the known recoverable petroleum resources. The fact that the energy resources represented by the coal are less readily extracted from the earth than those represented by the petroleum greatly increases the relative value of the petroleum resources. However, methods of recovery of coal resources are continuously changing, and it may be possible that energy resources represented by these vast supplies of coal can be made available without recourse to ordinary mining methods. Underground methods of gasification of coal have been under experimentation in Russia for several years. The great regularity of the Pennsylvanian system in Illinois and even the considerable depth of cover may be advantageous in underground gasification. The possibilities of the recovery of the energy in a coal bed in some form other than raw coal have been given very scant consideration.

Land owners in the counties included in this discussion should avoid attaching undue importance to the value of the coal resources on property within these counties. Undoubtedly the value of these resources will slowly increase, particularly if core-drilling verifies the conclusions reached on the basis of observation of rotary-drill holes. However, it is well to realize that a 4-foot coal bed at a depth of 800 to 1000 feet or more at present offers no competition to 6- to 8-foot beds found in southwestern and southern Illinois. In some countries the coal present in the Illinois basin would be of vital importance and of great immediate value, but we are fortunate that in Illinois for the present at least this is not the case. Nevertheless, as previously stated, methods of recovery are an intangible factor in determining future values.

TABLE 1.—ANALYSES OF COAL CUTTINGS FROM ROTARY-DRILL HOLES IN ILLINOIS BASIN AND CRAWFORD COUNTY

Analysis No.	C–2698	C–2699	C–2755	C–2756	C–2857	C–2858	C–2866	C–2906
Moisture	7.1	9.5	5.0	6.1	12.8	13.2	5.3	2.5
Volatile Matter	35.6	36.9	39.8	39.8	32.0	31.8	40.4	39.0
Fixed Carbon	44.1	45.9	48.4	44.7	38.0	37.4	45.8	47.0
Ash	13.2	7.7	6.8	9.4	17.2	17.6	8.5	11.5
Sulphur	2.71	2.69	2.45	2.32	2.43	1.90	3.57	3.74
B.t.u.	11,609	12,071	12,803	12,405	10,071	9,956	12,651	12,713
B.t.u. dry and mineral-matter-free (unit coal)	14,872	14,780	14,700	14,897	14,778	14,755	14,935	15,089
B.t.u. moist mineral-matter-free	13,617	13,232	13,887	13,875	12,424	12,336	14,036	14,646

C–2698 (Hole No. 111) Roy Lee—Miller No. 1, sec. 11, T. 4 N., R. 14 W., Richland County. Coal at depth 1000 to 1006 feet.
C–2699 Same drill hole as C–2698. Coal at depth 1,013 to 1,018 feet.
C–2755 (Hole No. 121) Ralph C. Halbert—Procter No. 1, sec. 17., T. 3 S., R. 14 W., Edwards County. Coal at depth 855 to 858 feet.
C–2756 Same drill hole as C–2755. Coal at depth 796 to 798½ feet.
C–2857 (Hole No. 145*) Ohio Oil Co.—Conrad No. 25, sec. 15, T. 5 N., R. 11 W., Crawford County. Coal at depth 498 to 508 feet.
C–2858 Same drill hole as C–2857. Coal at depth 566 to 573 feet.
C–2866 (Hole No. 147*) Livingston—Holtz No. 1, sec. 17, T. 2 N., R. 14 W., Richland County. Coal at depth 1,363 to 1,372 feet.
C–2906 (Hole No. 160*) Lloyd—Stevenson No. 1, sec. 8, T. 9 N., R. 9 E., Cumberland County. Coal at depth 1,457 to 1,462 feet.

*Holes Nos. 145, 147, and 160 were drilled since May 30, 1943.

TABLE 2.—DATA ON LOCATIONS OF ROTARY-DRILL HOLES STUDIED BY THE COAL DIVISION FEB. 1, 1942, TO MAY 30, 1943

Map No.	Co. No. **	Location				Company, farm, farm No.
		Twp.	Rge.	Sec.	¼ sec.	
				Christian County		
110	31	11 N	1 E	28	SE–SE–SW	Roy Lee, Trustee—Claribel-Nichols, 1
				Clay County		
87	30	5 N	5 E	23	SE–NW	National Petroleum—John Smith, 1
5	59	5 N	7 E	5	SE–SE	Gulf Refining Co.—Storck, 1
90	60	5 N	7 E	20	NW–NE–SE	Texas Co.—A. L. Hardin, 1
78	61	4 N	6 E	26	NW–SW–SE	Gulf Refining Co.—McCollum, 1
45	62	3 N	5 E	25	SW–NE–NE	Lain Oil & Gas Co.—Haynes, McConnell, 1
47	63	3 N	7 E	3	SW–NW	McBride—McNeely, 1
18	25	2 N	5 E	4	NW–NE	Carter Oil Co.—A. J. Walker, 1
9	64	2 N	6 E	1	C–NW–SE	A. H. Gibson—Valbert, 1
54	65	2 N	7 E	10	NW–NE	Pure Oil Co.—Pearly Baylor, 1
17	66	2 N	8 E	3	SE–NW	Pure Oil Co.—Mosely, B-5.
				Crawford County		
42	1	8 N	13 W	26	NE–NE–SW	G. F. Moulton—Lamb, 1
50	2	6 N	13 W	4	SE–SW	Waymire—Buck, 1
112	3	5 N	13 W	20	NE–SW–NE	W. C. Meridith—Wagner, 1
				Cumberland County		
124	27	10 N	7 E	3	NW–NW–NW	Papoose Oil Co.—Jeff Curry, 1
79	26	10 N	9 E	4	NE–SE–SW	Milo Ritchie—C. N. Greeson, 1
				Edwards County		
30	1	1 N	14 W	6	NW–SE	Sinclair Wyoming—August Bierhaus, 1
118	2	1 S	10 E	16	SE–SW–NW	Stanolind—Alvin Reid, 1
33	3	1 S	11 E	7	NW–NW–NW	Magnolia—Anna Gould, 1
123	4	2 S	10 E	8	SE–SW–NW	Nelson Development—Cameron Bunting, 1
15	5	2 S	10 E	19	C–SE–SE	Sun Oil Co.—McKibben, 1
51	6	3 S	10 E	8	NW–SE–SE	Sinclair Wyoming—Harry Perkins, 1
121	7	3 S	14 W	17	NE–NE–NE	Halbert—Proctor, 1
				Effingham County		
105	90	8 N	4 E	6	SW–NW–NW	Carter Oil Co.—Claggett, 1
114	91	8 N	5 E	34	SW–NE–SW	H. H. Weinert—Wm. Berry, 1
27	92	7 N	5 E	1	SW–NE–SE	Ohio Oil Co.—Clem Vogt, 1
21	50	6 N	5 E	34	NE–NW	Luttrell—Eugene See, 1
49	93	6 N	7 E	21	NE–SE	Kingwood—Wendte, 1
				Fayette County		
129	152	9 N	1 E	28	NW–NW–NE	Northern Ordnance Co.—Mary O'Connor, 1
25	808	8 N	3 E	3	SW–NE–SE	Carter Oil Co.—First State Bank, 1
119	121	8 N	3 E	10	C–NW–SE	Carter Oil Co.—Bob Fortner, 8-D
84	621	7 N	3 E	16	NE–SE	Carter Oil Co.—Mabel Wright, 1
104	175	6 N	2 E	36	NW–SE–NW	Ohio Oil Co.—C. T. Williams, 16
134	614	5 N	3 E	29	SW–SW–NE	Mid-Continent—Meyer, 1
				Franklin County		
2	353	5 S	2 E	5	SE–SE–SE	E. S. Adkins—Old Ben, L-1
140	671	7 S	2 E	25	NE–NE–SE	E. S. Adkins—Biggs, 1 "S"
1	672	7 S	3 E	21	NE–NW–SW	E. S. Adkins—Ice, 1
				Gallatin County		
55	119	7 S	8 E	21	C–SE–NE	Carter Oil Co.—R. O. Vinyard, 2
22	123	7 S	8 E	24	SW–SW–SW	Sinclair Wyoming—Isaac Cox, 1
56	133	7 S	9 E	22	NE–NE–NW	N. V. Duncan, Inc.—S. S. Knight, 1
58	136	7 S	10 E	33	NE–NE–NW	Kinkaid—Schmidt, 1
95	169	8 S	9 E	15	NW–NE–SW	Gulf Refining Co.—Leonard Bahl, 1
34	200	8 S	10 E	11	NE–SE–NW	Carter Oil Co.—Crawford, 1

**Standard County number used in Coal Division publications.

TABLE 2.—CONTINUED

Map No.	Co. No. **	Location				Company, farm, farm No.
		Twp.	Rge.	Sec.	¼ sec.	
				Hamilton County		
8	42	3 S	5 E	30	SE–SW	Seaboard Oil Co.—Kiefer, 1
96	43	3 S	6 E	22	NE–NE–NE	Mid-Continent—J. S. Ruben, 1
93	44	3 S	7 E	24	SE–NE	A. W. Cherry—Gardner, 3
130	45	4 S	5 E	1	NE–NE–SE	Texas Company—R. Rawls, 1
137	46	4 S	6 E	33	NW–SE	Wiser Oil Co.—Echols, 1
32	47	4 S	7 E	20	SE–NE	Texas Company—Minton, 1
69	48	6 S	6 E	11	SW–NE	Texas Company, E. McDonald, 6
52	49	6 S	7 E	5	NW–SW	Shell Oil Co.—J. C. Kern, 1
71	50	6 S	5 E	35	NW–NW–SE	Ohio Oil Co.—M. C. Moore, 6
107	51	6 S	6 E	34	NW–NE–NE	Texas Company—C. Johnson, 5
				Jasper County		
6	8	7 N	10 E	17	NW–SW–SW	Oexner Development Co.—Higgens, 1
59	9	6 N	10 E	17	SW–SW	Pure Oil Co., —Armistead, 1
38	10	5 N	8 E	4	NE–SE	Sinclair-Wyoming—Cook, 1
19	11	5 N	10 E	5	C–NE–SW	Pure Oil Co.—B. Cunningham, A-1
100	12	5 N	10 E	23	C–SE–SE	Gulf Refining Co.—Otto Hulse, 2
16	13	5 N	14 W	7	NE–NE	S. Lebow—Reis-Ochs, 1
				Jefferson County		
62	431	1 S	4 E	14	NW–SE–SW	Gulf Refining Co.—Lee Bradford, 1
53	95	2 S	4 E	34	SE–NE	Ohio Oil Co.—Ill. Central R. R., 1
101	424	2 S	4 E	36	NE–NW–SE	Lario Oil & Gas—Mountain-Mateer, 1
13	374	3 S	3 E	21	SW–SW–SE	Lewis Production Co.—State, 1
133	473	3 S	4 E	22	C–SW–SE	Sinclair-Wyoming—R. McReynolds, 1
136	474	4 S	3 E	36	SE–NW–NE	Deep Rock—I. H. Cox, 1
102	447	4 S	4 E	1	SW–SE–SW	Echols—Aydt, 1
				Lawrence County		
109	4	4 N	12 W	36	SW–SE–NE	E. S. Holmans—R. Kelley, 1
26	2	2 N	12 W	27	NE–NE–SW	Kabana (Ryan)—Schafer, 1
				Madison County		
60	442	3 N	6 W	3	SW–NW–SE	Watkins—Ziegler, 1
61	443	3 N	6 W	16	NE–SW	Obering-Bryant—Rhein, 1
63	444	3 N	6 W	15	SW–SW	Obering-Bryant—Meyers, 1
				Marion County		
113	1301	4 N	1 E	29	C–SE–SE	Adams Oil & Gas—Pugh, 10D
64	1043	4 N	3 E	35	NE–SE–SW	Papoose Oil Co.—Snelling, 1
75	986	4 N	4 E	21	NE–NE–SE	Ohio Oil Co.—S. Jones Comm., 1
35	160	1 N	2 E	16	NW–SE–NE	Texas Company—Fricke, 1
				Moultrie County		
127	9	15 N	6 E	13	NE–NW–NW	Continental Oil Co.—J. L. Beachy, 1
				Perry County		
70	99	4 S	4 W	14	SW–SW–NW	Texas Company—A. E. Leich, 1
				Richland County		
40	1	5 N	10 E	35	SE–SE–NE	Gulf Refining Co.—J. C. Ritter, 1
20	2	4 N	9 E	27	C–SW–NW	Pure Oil Co.—Murvin, B-2
39	3	4 N	10 E	22	NW–SE–NW	Texas Company—Hasslinger, 1
111	4	4 N	14 W	11	NW–SW–NW	Roy Lee, Trustee—John L. Miller, 1
135	5	3 N	9 E	31	C–SE–NW	Pure Oil Co.—E. A. Myers, 1
88	6	3 N	9 E	10	NW–SW–NW	Carter Oil Co.—Carrie Winters, 2
7	7	3 N	14 W	32	NE–SE–SW	Seaboard Oil Co.—Kimmel, 1
				Saline County		
24	835	7 S	7 E	26	SW–SW–SW	Sinclair Wyoming—Garner, 1

**Standard County number used in Coal Division publications.

TABLE 2.—CONCLUDED

Map No.	Co. No. **	Location				Company, farm, farm No.
		Twp.	Rge.	Sec.	¼ sec.	
				Shelby County		
73	98	11 N	3 E	21	NE–SE–NW	Harry H. Sims—Bauer, 1
3	66	10 N	4 E	8	C–SE–SW	Illinois Exploration Co.—Davis, 1
				Wabash County		
92	99	1 N	13 W	26	NW–SW–SW	W. E. Bailor—Liddle, 3
99	36	1 N	13 W	26	NW–NW–SW	Central Pipe Line—Liddle, 1
115	94	1 N	12 W	19	NE–NW–SW	C. E. Skiles—Price, 1
48	116	1 N	12 W	16	NE–SE–NW	W. R. White & Son—Cozine, 1
57	86	1 S	13 W	3	NE–SE	C. E. Skiles—Wheatley, 1
117	118	1 S	13 W	10	SE–NE–NE	Magnolia Oil Co.—Sturman, 3
43	119	1 S	12 W	16	SE–SW–SE	H. M. Horton—Mary B. Carson, 2
116	120	1 S	12 W	17	SW–SW–SW	Shell Oil Co.—F. E. Parkinson, 2
125	121	2 S	13 W	3	SW–SW–NW	Sinclair Wyoming—Strasser, 2
23	122	3 S	14 W	22	SW–SW–SE	Longhorn Oil Co.—Edith Helm, A-30
				Washington County		
122	355	3 S	3 W	26	SW–NW–NW	Magnolia Oil Company—Gill Estate, 10
80	342	3 S	2 W	26	NE–NE–NW	Texas Company—J. Bain, 1
				Wayne County		
128	529	2 N	6 E	26	NE–NE–SW	Gulf Refining Co.—Gladys, 1
103	444	2 N	8 E	21	NW–SE–SE	Pure Oil Co.—Lou Patterson, 1
108	443	1 N	7 E	2	C–SE–SW	Pure Oil Co.—Al Riggs, A-1
37	396	1 N	7 E	17	NE–NE–NE	Shell Oil Co.—Marie Rutger, 1
77	400	1 N	8 E	14	NW–SW–NW	Pure Oil Co.—Webster, 1
14	98	1 N	8 E	34	SE–NW	Hupp—Faris, 1
66	408	1 S	5 E	1	SE–NW	Gulf Refining Co.—Frank Melton, 1
4	462	1 S	5 E	18	C–NW–NE	Gulf Refining Co.—Minor & Ellis, 1
12	395	1 S	6 E	20	C–NW–NE	B. Taylor (Duncan)—A. Dickey, 1
67	398	1 S	6 E	32	NW–SW	Gulf Refining Co.—Laura Gregg, 1
91	403	1 S	6 E	4	NW–NE–NW	Mid Continent Pet.—E. E. Spitzner, 1
72	399	1 S	7 E	13	NE–NE–SE	Pure Oil Co.—C. W. Blackburn, A-2
41	471	1 S	7 E	19	C–NE–SE	Gulf Refining Co.—Blackburn-Thomas, 3
97	405	1 S	8 E	7	NW–NW–SE	Deep Rock Oil Co.—Cantley Rec. St. Louis Bank, 1
11	409	2 S	5 E	11	NE–NW–SE	Sinclair Wyoming—Stella Edmison, 1
120	410	2 S	5 E	35	C–SW–NW	Deep Rock Oil Co.—Jessie Anderson, 1
94	487	2 S	6 E	12	C–NE–SW	Deep Rock Oil Co.—Atkinson-Windland Comm., 1
89	435	2 S	7 E	2	NE–NE–SW	Gulf Refining Co.—Paul Carter, 1
83	401	2 S	7 E	33	SW–NE–SE	Texas Company—C. Holacher, 1
10	195	2 S	8 E	4	SW–NE	Watkins Drilling Co.—Southerland, 1
82	239	2 S	9 E	4	NW–SE–SW	Bell Brothers—Allison, 1
139	528	2 S	9 E	29	NW–SE	New Penn Development—Kistner, et al., 1
46	248	3 S	6 E	8	SW–NW	The Texas Company—Butler-Buchanan Comm., 1
65	397	3 S	7 E	16	C–NE–NW	The Texas Company—H. Silverman, 5
98	300	3 S	8 E	6	SW–SE–NE	Weinert—Davis Heirs, 1
81	438	3 S	9 E	1	C–SE–NW	Cherry & Barron Kidd—P. J. Siefert, 1
				White County		
138	421	3 S	14 W	31	NE–SW–SE	Duncan—Ben E. Metcalf, 2
31	422	4 S	10 E	6	C–SE–NW	Sun Oil Co.—Bixenstine, B-2
86	423	4 S	10 E	18	NE–NW	Gulf Refining Co.—Bryant (Carter), 2
106	424	4 S	10 E	25	NE–NE	Phillips Petroleum Co.—Kuykendall, 1
131	425	4 S	14 W	6	SW–NE–NE	McBride—Howard, 1
28	426	4 S	14 W	21	SW–NE–NE	Sun Oil Co.—Ford, B-4
36	427	5 S	9 E	9	SW–SW–SW	Nash Redwine—Bachman, 1
85	428	5 S	10 E	1	NW–NE–NE	Jarvis Bros. & Marcell—Lorraine Cleveland, 1
29	176	5 S	10 E	14	C–SE–NW	Robinson-Puckett—Bert Patrick, 1
126	429	5 S	14 W	4	NE–NE–SE	Superior Oil Co.—E. S. Greathouse, 12
74	430	6 S	9 E	17	NW–SW–NW	Pure Oil Co.—H. Austin, A-1
132	431	6 S	9 E	27	NW–NW–NW	Pure Oil Co.—Austin-Wilson Consol., 1
68	432	6 S	10 E	12	C–SE–SW	Riddle (Capshaw)—Meyers, 1
76	433	7 S	10 E	15	SE–SE–SE	Gulf Refining Co.—Harlem, 1
44	434	7 S	11 E	19	SW–SW–SE	Hiawatha Oil Co.—Joe Vail, 5

**Standard County number used in Coal Division publications.

TABLE 3.—DATA ON WORKABLE COAL BEDS PRESENT IN ROTARY-DRILL HOLES STUDIED BY THE COAL DIVISION[1]
FEB. 1, 1942, TO MAY 30, 1943

Map No. (Fig. 12)	Surface elevation (Instrumental) Datum sea-level	Coal No.	Depth to top coal bed ft.	Elevation top coal bed Datum sea-level ft.	SEDIMENTARY SUCCESSION Based on laboratory study of drill-cuttings: Above coal bed (thickness in ft.)	Coal bed ft.	Coal bed in.	Below coal bed (thickness in ft.)
					Christian County			
110[a]	676		680	−4	Gray shale 4; black shale[b] 2	3	0	Siltstone[c] and shale 3; limestone 2
		6	710	−34	Gray shale 6; black shale 2	6	0	Underclay 2; limestone 2; siltstone 10
					Clay County			
87	479	6?	998	−519	Sandstone 24; black shale 1	4	0	Underclay 1; sandstone 24
5					No coal beds of workable thickness			
90	501	6	1064	−563	Limestone 5; black shale 1	4	0	Underclay 1; gray shale 5
78	478		384	94	Gray shale 4; black shale 1	3	6	Underclay 1; gray shale 9
			622	−144	Gray shale 8; black shale 1	4	0	Underclay 1; siltstone 13
			1022	−544	Gray shale 25; black shale 2	4	0	Underclay 3; gray shale 7
		6	1050	−572	Gray shale 8; limestone 4	4	0	Underclay 1; gray shale 9
45[a]	514	6?	962	−448	Limestone 2; black shale 2	4	0	Underclay 2; variegated shale 32
			1021	−507	Gray shale 14; black shale 2	3	0	Underclay 1; limestone 2
47	435		970	−535	Sandstone 40; black shale 1	4	0	Underclay 1; sandstone 9
		6	1014	−579	Limestone 4; sandstone 6	5	0	Underclay 1; gray shale 6
			1149	−714	Shale and sandstone 49; black shale 1	3	0	Sandstone 31
18	543	6?	1054	−511	Limestone 2; black shale 2	4	0	Shaly limestone 10; gray shale 47
			1119	−576	Gray shale 47; black shale 4	4	0	Gray shale 2; limestone 2
9					No coal beds of workable thickness			
54	430	6?	1010	−580	Sandstone 20; black shale 2	4	0	Underclay 4; shale 2
17					No coal beds of workable thickness			

					Crawford County			
42	590		504	86	Shale 11; sandstone 2	3	0	Underclay 3; shale and nodular limestone 5
		6	544	46	Limestone 4; black shale 1	4	0	Underclay 4; shale 4
			662	−72	Shale 17; black shale 1	3	6	Underclay 2; shale 6
			792	−202	Shale 7; black shale 1	3	0	Underclay 3; black shale 2
			799	−209	Underclay 3; black shale 2	4	0	Underclay 4; gray shale 3
50	473		385	88	Limestone 3; gray shale 7	4	0	Underclay 1; gray shale 2
			431	42	Limestone 4; black shale 3	6	0	Underclay 3; siltstone 10
			489	−16	Gray shale 7	3	0	Sandstone 3; siltstone 30
			686	−213	Gray shale 10; black shale 1	8	0	Underclay 5; clay and sandstone 7
			804	−331	Shale and siltstone 14; black shale 1	4	0	Underclay 2; gray shale 2
112	498		759	−261	Siltstone and shale 5; black shale 1	3	6	Underclay 1; gray shale 7
			807	−309	Siltstone 7; limestone 1; black shale 1	3	0	Underclay 2; siltstone 2
			818	−320	Limestone 4; black shale 1	4	0	Underclay 1; siltstone and shale 5
			880	−382	Limestone 3; black shale 2	3	6	Underclay 4; gray shale 3
					Cumberland County			
124					No coal beds of workable thickness			
79	612		1079	−467	Siltstone and sandstone 8; black shale 1	4	0	Underclay 1; gray shale 16
					Edwards County			
30	497		608	−111	Gray shale 25	3	0	Underclay 2; sandy shale 7
			913	−416	Gray shale 28; black shale 1	3	0	Gray shale 4; limestone 2
		6?	966	−469	Limestone 5; black shale 1	4	0	Underclay 4; siltstone 4
			1046	−549	Limestone 3; black shale 1	4	0	Underclay 3; siltstone 2
118	427	7?	893	−466	Gray shale 57	3	0	Underclay 1; gray shale 16
		6?	940	−513	Limestone 2; black shale 2	5	0	Sandstone 60
			1034	−607	Limestone and shale 4; black shale 1	4	0	Underclay 1; sandstone 12
			1289	−862	Shale 3; black shale 1	4	0	Sandstone 10
33	507		936	−429	Shale 4; black shale 2	4	0	Sandstone and shale 20
		6?	1020	−513	Sandstone and limestone 60; black shale 2	4	0	Underclay 3; gray shale 7
			1136	−629	Gray shale 38; black shale 2	4	0	Underclay 2; calcareous sandstone 16
			1159	−652	Calcareous sandstone 16	3	0	Shale 32
			1270	−763	Shale 27; black shale 1	4	0	Underclay 2; sandy shale 4
			1303	−796	Sandstone 9; black shale 2	3	0	Sandstone 16

[a] Drill-cuttings studied in field only.
[b] Black shale includes black "slate."
[c] Siltstone is a very fine-grained sandstone.

TABLE 3.—(Continued)

Map No. (Fig. 12)	Surface elevation (Instrumental) Datum sea-level	Coal No.	Depth to top coal bed ft.	Elevation top coal bed Datum sea-level ft.	SEDIMENTARY SUCCESSION Based on laboratory study of drill-cuttings			
					Above coal bed (thickness in ft.)	Coal bed ft.	in.	Below coal bed (thickness in ft.)
					Edwards County—(Concluded)			
123	469	6?	975	−506	Gray shale 10; black shale 2	4	0	Underclay 2; shale and limestone 8
15[a]	437		862	−425	Gray shale 50	3	0	Gray shale 35
		6?	938	−501	Limestone 4; black shale 2	5	0	Gray shale 6; limestone 3
51	414	6?	878	−464	Limestone 4; black shale 2	5	0	Underclay 1; sandy shale 8
121	406	6?	853	−447	Limestone 3; black shale 2	5	0	Underclay 1; shale and limestone 10
					Effingham County			
105					No coal beds of workable thickness			
114	594	6?	904	−310	Gray shale 12; black shale 2	3	0	Underclay 1; gray shale 15
			951	−357	Gray shale 5; black shale 1	4	0	Underclay 1; gray shale 2
27	586		358	228	Gray shale 22	3	0	Underclay 1; gray shale 4
			542	44	Gray shale 20; black shale 2	2	6	Gray shale 6
21	556	6?	960	−404	Gray shale 5; limestone 5	5	0	Underclay 1; shale and sandstone 34
49	560	6?	1143	−583	Limestone 7; black shale 1	5	0	Underclay 1; siltstone 26
			1180	−620	Limestone and shale 6	5	0	Underclay 1; gray shale 12
			1258	−698	Gray shale 48; black shale 2	3	0	Underclay 1; silty shale 38
					Fayette County			
129	629	6?	757	−128	Gray shale 3; black shale 5	6	0	Underclay and nodular limestone 5
			770	−141	Underclay and nodular limestone 5; black shale 1	3	0	Limestone 2; black shale 6
			942	−313	Siltstone 11; black shale 1	3	0	Underclay 1; limestone and sandstone 5
25	599		840	−241	Shale and sandstone 18; black shale 2	4	0	Underclay 2; sandstone 36
119	630		878	−248	Gray and black shale 10	3	0	Gray shale 13
84	603		666	−63	Gray shale 62	4	0	Underclay 2; siltstone 4
		6?	769	−166	Gray shale 37; black shale 1	3	0	Underclay 1; gray shale 17

104	587	6?	769	−182	Gray shale 6; black shale 1	4 0	Underclay 1; siltstone 30
134	585	6?	766	−181	Limestone 2; black shale 1	5 0	Underclay 1; sand and shale 6
					Franklin County		
2	450	6	669	−219	Gray shale 30	6 0	Underclay 3; limestone 5
		5	708	−258	Limestone 7; gray shale 8	5 0	Underclay 7; gray shale 30
140	391	6	417	−26	Gray shale 10	8 0	Underclay 3; limestone 9
		5	463	−72	Gray shale 5; black shale 5	4 0	Underclay 1; gray shale 5
1	398		320	78	Shale, clay, coal streaks 6	5 0	Sandstone 20
		6	448	−50	Limestone 15; black shale 3	7 0	Underclay 3; limestone 4
		5	494	−96	Black and gray shale 10	4 0	Limestone and shale 7
			614	−216	Gray shale 26	3 0	Shale and clay 8
					Gallatin County		
55	408	6	457	−49	Limestone 2; black shale 1	5 0	Underclay 4; sandstone 4
22	395	6	508	−113	Black shale 6; limestone 3	7 0	Underclay 1; sandstone 10
		5	627	−232	Limestone 3; black shale 2	4 0	Underclay 5; sandstone 9
			703	−308	Limestone 3; black shale 4	3 0	Underclay 2; gray shale 27
			860	−465	Sandstone and shale 4; black shale 1	4 0	Underclay 2; sandstone 18
56	412	6?	685	−273	Limestone 3; black shale 1	5 0	Underclay 2; siltstone 32
			779	−367	Silty shale 28; black shale 1	5 0	Underclay 2; shale and sandstone 6
			879	−467	Limestone 2; black shale 1	3 0	Shale and limestone 10
58	350	6	405	−55	Limestone 3; black shale 1	5 0	Underclay 1; gray shale 6
95	371	6	482	−111	Limestone 5; black shale 1	7 0	Shale 1; sandstone 12
34	353	6?	315	38	Limestone 3; black shale 3	5 0	Underclay 5; sandstone 12
		5?	407	−54	Sandstone 2; shale 2	5 0	Shale 1; limestone 2
		DK.[d]	682	−329	Shale and siltstone 12; black shale 1	3 0	Underclay 2; sandstone 5
		Dav.[e]	709	−356	Shale and siltstone 12; black shale 3	2 6	Underclay 2; shale 4
					Hamilton County		
8	424		700	−276	Gray shale 15	4 0	Siltstone 14
		6?	1014	−590	Gray shale 12; limestone 2	3 0	Gray shale 15
96					No coal beds of workable thickness.		

[a] Drill-cuttings studied in field only.
[d] DeKoven coal.
[e] Davis coal.

TABLE 3.—(Continued)

Map No. (Fig. 12)	Surface elevation (Instrumental) Datum sea-level	Coal No.	Depth to top coal bed ft.	Elevation top coal bed Datum sea-level ft.	SEDIMENTARY SUCCESSION Based on laboratory study of drill-cuttings		
					Above coal bed (thickness in ft.)	Coal bed ft.	in.	Below coal bed (thickness in ft.)
					Hamilton County—(Concluded)			
93	377	6	948	−571	Limestone 6; black shale 2	6	0	Underclay 2; sandstone 24
		5?	1030	−653	Gray shale 10; black shale 1	4	0	Underclay 2; gray shale 4
130	440	6	972	−532	Limestone 6; black shale 1	4	0	Underclay 5; shale 3
		5	1074	−634	Limestone 2; shale 3; black shale 1	4	0	Underclay 3; shale 6
137	412	6	1001	−589	Limestone 6; black shale 3	5	0	Underclay 1; sandstone 16
		5	1073	−661	Gray shale 4; black shale 1	4	0	Underclay 1; siltstone 16
32	425	6	963	−538	Limestone 2; black shale 3	6	0	Gray shale 1; sandstone 35
69	403		556	−153	Gray shale 43; black shale 1	3	0	Underclay 1; gray shale 2
		6	642	−239	Gray shale 4; black shale 2	5	0	Underclay 1; gray shale 5
		5	724	−321	Siltstone 47; black shale 1	5	0	Gray shale 40
52	390		592	−202	Shale 27	3	0	Shale 14
		6	655	−265	Limestone 5; siltstone 1	5	0	Sandstone 3; limestone 3
		5	756	−366	Sandstone 43; black shale 1	6	6	Shale 5; sandstone 25
			994	−604	Sandstone 17; black shale 1	4	6	Sandstone 2
71	500		722	−222	Gray shale 10; black shale 2	3	0	Underclay 1; sandstone 4
		6	800	−300	Limestone 4; black shale 4	6	0	Underclay 4; gray shale 4
		5	872	−372	Sandstone 12; black shale 2	4	0	Underclay 1; gray shale 7
107	387		575	−188	Gray shale 41; black shale 1	3	0	Underclay 1; gray shale 5
		6	646	−259	Limestone 5; black shale 2	6	0	Underclay 2; sandstone 18
		5	752	−365	Siltstone 70; black shale 2	4	0	Underclay 2; gray shale 2
					Jasper County			
6	543	6?	1138	−595	Gray shale 26	4	0	Gray shale 2; limestone 4
		6?	1150	−607	Limestone 4; gray shale 2	3	0	Gray shale 7; limestone 2
59	523		1010	−487	Gray shale 2; black shale 2	4	0	Underclay 2; shale 4

38	524	6?	1138	−614	Limestone 4; black shale 1	4	0	Underclay 1; shale 3
		5?	1181	−657	Gray shale 2; black shale 1	4	0	Gray shale 33
19	510		919	−409	Gray shale 31; black shale 1	4	0	Gray shale 6; limestone 7
		6?	988	−478	Limestone 5; gray shale 2	6	0	Gray shale 6
100	482	6?	1086	−604	Limestone 4; black shale 1	4	0	Underclay 3; sandstone 13
16	460		527	−67	Shale 40; black shale 2	3	0	Gray shale 10; limestone 4
			554	−94	Limestone 4; sandstone and shale 12	3	0	Underclay 2; gray shale 5
			920	−460	Gray shale 51; black shale 2	3	0	Underclay 3; gray shale 6
					Jefferson County			
62[a]	482	6	924	−442	Limestone 4; black shale 1	5	0	Underclay 1; gray shale 20
		5?	1089	−607	Gray shale 18; black shale 1	3	0	Underclay 1; gray shale 7
53	503	6	983	−480	Gray shale 29; black shale 2	6	0	Underclay 2; gray shale 14
		5	1073	−570	Limestone 2; shale and coal 4	4	0	Underclay 4; gray shale 19
101	455	6	944	−489	Limestone 3; black shale 2	4	6	Underclay 3; sandstone 2
		5	1030	−575	Coal and black shale 6	6	0	Underclay 3; gray shale 2
13	494		272	222	Sandstone 10; gray shale 2	3	0	Gray shale 6; sandstone 16
		6	814	−320	Shale 10; black shale 2	6	0	Gray shale 2; sandstone 7
		5	888	−394	Limestone 2; black shale 2	6	0	Siltstone 16
			1075	−581	Limestone 6; gray shale 6	3	0	Underclay 1; gray shale 6
133	465	6	889	−424	Sandstone 23; limestone 5	6	0	Underclay 2; sandstone 13
		5	966	−501	Limestone 3; black shale 1	3	0	Underclay 2; limestone 2
136	472		182	290	Sandstone and limestone 5; black shale 1	4	0	Underclay 2; gray shale 5
		6	814	−342	Gray shale 21; black shale 1	4	0	Underclay and nodular limestone 6
102	462	6	927	−465	Limestone 3; black shale 1	4	0	Underclay 1; sandstone 37
		5	1007	−545	Siltstone 22; black shale 1	4	0	Underclay 1; sandstone 8
					Lawrence County			
109	418		350	68	Shale and siltstone 6; black shale 1	4	0	Gray shale 6; sandstone 28
			409	9	Sandstone 17; black shale 1	3	0	Underclay 4; limestone 4
			514	−96	Limestone 4; black shale 1	3	0	Underclay 4; sandstone and limestone 6
			595	−177	Gray shale 18	3	0	Sandstone 5; limestone 12

TABLE 3.—(Continued)

Map No. (Fig. 12)	Surface elevation (Instrumental) Datum sea-level	Coal No.	Depth to top coal bed ft.	Elevation top coal bed Datum sea-level ft.	SEDIMENTARY SUCCESSION Based on laboratory study of drill-cuttings			
					Above coal bed (thickness in ft.)	Coal bed ft.	in.	Below coal bed (thickness in ft.)
					Lawrence County—(Concluded)			
26	452		494	−42	Gray shale 24	4	6	Underclay 3; shale and limestone 9
			516	−64	Limestone 3½	3	0	Underclay 1; shale and limestone 4
			850	−398	Sandstone 4; coal 2; shale 1	3	0	Sandstone and shale 27
			958	−506	Sandstone and shale 34	2	6	Underclay 1; shale and limestone 4
					Madison County			
60	490		356	134	Siltstone 28; gray shale 6	4	0	Underclay 2; siltstone 10
61					No coal beds of workable thickness.			
63	494		260	234	Gray shale 22; black shale 6	3	0	Underclay 3; gray shale 3
			353	141	Gray shale 28; black shale 1	3	0	Gray shale 30
			391	103	Limestone 2; black shale 3	3	0	Gray shale 2; limestone 2
			404	90	Gray shale 4; black shale 2	4	0	Gray shale 6
			414	80	Gray shale 6	3	0	Underclay 2; gray shale 7
					Marion County			
113[a]	500	6	506	−6	Limestone 4; black shale 2	8	0	Underclay 2; sandstone 20
		5	544	−44	Sandstone 20; limestone 7	3	0	Underclay 3
64	625	6	916	−291	Limestone 4; black shale 1	4	0	Underclay 2; limestone 2
75	586	6	881	−295	Sandstone 24; black shale 1	4	0	Sandstone 3; limestone 2
		5?	953	−367	Gray shale 12; black shale 1	3	0	Gray shale 9; limestone 1
35	564	6?	836	−272	Sandstone, shale, siltstone 36	4	0	Underclay 1; gray shale 10
			1087	−523	Sandstone 3; gray shale 9	5	0	Gray shale 10
					Moultrie County			
127	665		345	320	Limestone and shale 10	3	0	Underclay 2; shale 10
		5	1108	−443	Silty shale 29; black shale 1	4	0	Underclay 2; shale 19

					Perry County			
70	532		260	272	Limestone 7; shale 2	7	0	Underclay 1; shale 2
			355	177	Limestone 2; gray and black shale 1	5	0	Gray shale 2; limestone 1
			400	132	Sandstone 14; limestone 2	3	6	Underclay 1; sandstone 4
			434	98	Sandstone 24	3	0	Underclay 1; gray shale 6
					Richland County			
40	510		566	−56	Limestone 4; black and gray shale 6	3	0	Gray shale 32
			1009	−499	Silty shale 6; black shale 3	3	0	Gray shale 14
		6?	1098	−588	Limestone 4; black shale 4	5	0	Underclay 1; gray shale 16
20	530		600	−70	Limestone 3; black shale 2	3	0	Sandstone 7; gray shale 4
			1022	−492	Gray shale 40; black shale 2	8	0	Underclay 2; gray shale 3
		6?	1107	−577	Gray shale 6; black shale 1	5	0	Gray shale 19
		5?	1134	−604	Gray shale 19; black shale 2	4	0	Gray shale 22
39	471		385	86	Gray shale 6; black shale 1	3	0	Underclay 1; limestone and shale 3
			490	−19	Limestone and shale 4; black shale 1	2	6	Shale and sandstone 7
			699	−228	Gray shale 4; black shale 1	3	6	Underclay 2; shale and limestone 4
		6	1031	−560	Shale and limestone 14; black shale 2	4	0	Shale and limestone 17
		5	1081	−610	Gray shale 5; limestone 3	4	6	Gray shale 10
			1435	−964	Gray shale 10; black shale 1	5	0	Shale and sandstone 20
			1459	−988	Shale and sandstone 20	3	0	Underclay 2; sandstone 5
111	483		1002	−519	Limestone 3; black shale 1	4	0	Underclay and siltstone 3
		6?	1013	−530	Siltstone 3; limestone 4	4	6	Underclay 6; sandstone 22
		5?	1076	−593	Gray shale 7; black shale 2	4	0	Gray shale 6; sandstone 24
135[a]	451		270	181	Gray sandy shale 10; black shale 1	3	0	Underclay 3; gray shale, 10
		6?	967	−516	Limestone 3; shale 3	3	0	Soft gray shale
		5?	1031	−580	Gray shale 11	3	0	Underclay 1; gray sandy shale 10
88	483	6?	1015	−532	Limestone 4; black shale 1	4	0	Underclay 5; gray shale 26
		5?	1084	−601	Gray shale 14; black shale 2	3	0	Underclay 2; gray shale 11
7[a]	463	6?	962	−499	Limestone 1; gray shale 5	4	0	Gray shale 2; limestone 2
					Saline County			
24	373	6	447	−74	Limestone 5; black shale 2	6	0	Underclay 5; sandstone 4
					Shelby County			
73					No coal beds of workable thickness.			
3					No coal beds of workable thickness.			

[a] Drill-cuttings studied in field only.

TABLE 3.—(Continued)

Map No. (Fig. 12)	Surface elevation (Instrumental) Datum sea-level	Coal No.	Depth to top coal bed ft.	Elevation top coal bed Datum sea-level ft.	SEDIMENTARY SUCCESSION Based on laboratory study of drill-cuttings			
					Above coal bed (thickness in ft.)	Coal bed ft.	in.	Below coal bed (thickness in ft.)
					Wabash County			
92	492	Fr.?[f]	87	405	Sandstone 4; black shale 3	3	0	Limestone 2; sandstone 10
			159	333	Gray shale 4; black shale 1	3	0	Limestone 4; sandstone 8
			658	—166		4	0	
		6?	696	—204	Sandstone 4; gray shale 5	4	0	Gray shale 2; limestone 2
		5?	781	—289	Limestone 2; black shale 1	4	0	Sandstone and limestone 33
			866	—374	Sandstone 4; black shale 3	3	0	Limestone 2; siltstone 6
99	498	Fr.?[f]	58	440	Gray shale 16	4	0	Underclay 4; limestone 4
		6?	707	—209	Sandstone 10; gray shale 2	4	0	Limestone 2; clay 2
		5?	793	—297	Limestone 3; black shale 2	4	0	Underclay 1; siltstone 3
115	415[g]		274	141	Limestone 1; gray shale 4; black shale 1	3	0	Underclay 1; gray shale 7
		6?	567	—152	Sandstone 16; black shale 1	4	0	Sandstone 14
48	425		499	—74	Gray shale 18; black shale 1	5	0	Underclay 1; gray shale 4
		6?	554	—129	Sandstone 4; black shale 1	5	0	Underclay 3; sandstone 20
		5?	644	—219	Sandstone 26; black shale 4	4	0	Siltstone 32
			789	—364	Shaly siltstone 26; black shale 1	3	0	Underclay 1; silty shale 8
57	485	Fr.?[f]	75	410	Sandstone 4; black shale 4	3	0	Sandstone 4; sandy shale 32
			405	80	Siltstone 24; black shale 1	2	6	Gray shale 12
		6?	736	—251	Siltstone 26; black shale 2	5	0	Underclay 1; siltstone 6
		5?	801	—316	Siltstone 28; black shale 1	5	0	Underclay 1; gray shale 21
		5?	840	—355	Limestone 2; gray shale 10	7	0	Underclay 1; siltstone 8
		4?	898	—413	Limestone 2; black shale 1	4	0	Underclay 1; siltstone 8
117	487	Fr.?	41	446	Limestone 2; gray shale 1	4	0	Gray shale 4
43	396		374	22	Gray shale 12; black shale 2	4	0	Underclay 1; gray shale 13
		6?	411	—15		5	0	
			483	—87	Sandstone 40; gray shale 2	3	0	Sandstone and shale 22
		5?	537	—141	Gray shale 27; black shale 1	4	0	Underclay 1; gray shale 6
			638	—242	Limestone 3; black shale 1	3	0	Underclay 1; gray shale 6
			732	—366		4	0	
			785	—389	Sandstone 11; gray shale 1	4	0	Gray shale 7; limestone 2

116	437	6?	495	−58	Gray shale 7; limestone 1; black shale 1	2	6	Gray shale 5
			851	−414	Sandstone 2; black shale 2	3	0	Sandstone 10
125	410		353	57	Gray shale 18	3	0	Gray shale 19
		6?	678	−268	Gray shale 2; black shale 2	3	0	Underclay 1; gray shale 5
23	376	6?	760	−384	Limestone 7; black shale 5	5	0	Underclay 5; sandstone 25
		5?	848	−472	Limestone 5; gray shale 15	4	0	Underclay 1; gray shale 16
		4?	938	−562	Sandstone 5; black shale 6	4	0	Underclay 2; gray shale 30
			1058	−682	Sandstone 52; black shale 1	4	0	Gray shale 25
			1139	−763	Gray shale 22; black shale 1	3	0	Underclay 2; gray shale 8
					Washington County			
122	525		211	314	Limestone 6; black shale 2	3	0	Gray shale 2; limestone 3
		6	250	275	Limestone 12; black shale 1	9	0	Underclay 3; limestone 7
80[a]	473	6	228	245	Limestone 7; black shale 2	7	0	Underclay 5; gray shale 10
		5	304	169	Sandstone 46; gray shale 8	3	0	Underclay 1; gray shale 18
		4	381	92	Gray shale and coal 10; black shale 1	3	0	Underclay 1; sandstone 15
					Wayne County			
128	471		762	−291	Sandstone and siltstone 53; black shale 1	3	0	Underclay 1; gray shale 18
		6	1085	−614	Sandstone and siltstone 15; black shale 1	6	0	Underclay 2; sandstone 8
		5	1151	−680	Sandstone 18; black shale 1	4	0	Underclay 1; shale and clay 10
103	454	6	1025	−571	Limestone 4; black shale 1	4	0	Underclay 3; sandstone 10
		5	1086	−632	Siltstone 12; limestone 1; black shale 3	5	0	Underclay 3; limestone 2
			1290	−836	Gray shale 18; black shale 2	3	6	Underclay 2; sandstone 40
108	444	6	984	−540	Gray shale 28; black shale 2	3	0	Underclay 1; limestone 6
		5	1047	−603	Gray shale 14; black shale 2	5	0	Underclay 2; siltstone 50
			1142	−698	Limestone 2; black shale 2	4	0	Gray shale 22
			1171	−727	Gray shale 22; black shale 2	3	0	Gray shale 36
37	475	6	1055	−580	Gray shale 8; limestone 1; black shale 1	5	0	Underclay 1; gray shale 7
		5	1119	−644	Gray shale 8; black shale 1	4	0	Underclay 1; gray shale 22
			1327	−852	Gray shale 5; black shale 2	4	0	Gray shale 20
77	421	6	1011	−590	Gray shale 8; limestone 4	3	0	Siltstone 16; sandstone 9
			1054	−633	Siltstone 13; black shale 1	2	6	Underclay 1; sandstone 24
		5	1083	−662	Sandstone 24	4	0	Underclay 1
14	391		913	−522	Gray shale 52; black shale 1	4	0	Gray shale 1; sandstone 2; limestone 2
		6	950	−559	Gray shale 2; limestone 4	5	0	Limestone 9
		5	1022	−631	Gray shale 4; limestone 4	4	0	Gray shale 4

[a] Drill-cuttings studied in field only.
[f] Friendsville coal.
[g] Topographic map estimate.

TABLE 3.—(Continued)

Map No. (Fig. 12)	Surface elevation (Instrumental) Datum sea-level	Coal No.	Depth to top coal bed ft.	Elevation top coal bed Datum sea-level ft.	SEDIMENTARY SUCCESSION Based on laboratory study of drill-cuttings			
					Above coal bed (thickness in ft.)	Coal bed ft.	in.	Below coal bed (thickness in ft.)
					Wayne County—(Concluded)			
66	491	6	1014	−523	Gray shale 14; limestone 4	5	0	Underclay 1; siltstone 2; limestone 2
		5	1087	−596	Gray shale 10; limestone 2; black shale 1	3	0	Underclay 1; gray shale 3
4	478	5?	1031	−553	Gray shale 14; black shale 4	3	0	Sandstone 25
12	447		926	−479	Limestone 2; gray shale 6	4	0	Gray shale 18
		6?	986	−539	Shale and sandstone 12; limestone 4	5	0	Sandy shale 35
67	435				No coal beds of workable thickness.			
91	484		985	−501	Siltstone and shale 38	3	0	Underclay 1; siltstone 10
72	420	6	994	−574	Gray shale 4; limestone 4	4	6	Underclay 1; sandstone 22
		5	1078	−658	Sandstone 29; black shale 3	3	0	Sandstone 5
41	464		965	−501	Gray shale 12; black shale 3	3	0	Gray shale 14
		6	1018	−554	Gray shale 10; limestone 4	6	0	Siltstone 24
			1069	−605	Gray sandy shale 20; black shale 1	3	0	Siltstone 24
		5	1098	−634	Sandstone 24; black shale 2	4	0	Underclay 2; gray shale 26
97	440	6	986	−546	Limestone 5; black shale 1	4	0	Siltstone 12
		5?	1068	−628	Linestone 3; black shale 1	3	0	Underclay 1; sandstone 14
11[a]	404		909	−505	Shale 19	3	0	Shale 28
		6	982	−578	Gray shale 18; limestone 4	6	0	Gray shale 40
120	465		967	−502	Siltstone 23; black shale 2	2	6	Underclay 1; gray shale 10
		6	1030	−565	Limestone 4; black shale 1	5	0	Underclay 2; sandstone 32
		5	1124	−659	Gray shale 11; black shale 1	4	0	Underclay 2
94	401	6	998	−597	Sandstone 30; limestone 2; black shale 4	6	0	Underclay 4; sandstone 10
89	424	5?	1064	−640	Limestone 2; black shale 4	4	0	Underclay 3; sandstone 33

83	383		885	−502	Gray shale 54; black shale 1	3	0	Underclay 1; sandstone 21
		6	962	−579	Limestone 4; black shale 1	5	0	Underclay 1; sandstone 26
		5	1038	−655	Gray shale 5; black shale 1	3	0	Siltstone 70
10[a]	419		942	−523	Gray shale 30; limestone 2	3	0	Underclay 2; sandy shale 17
			983	−564	Limestone 4; gray shale 14	3	0	Gray shale 26
		6?	1018	−599	Limestone 2; black shale 4	4	0	Shale 8
82	387		1167	−780	Limestone 2; black shale 2	3	0	Underclay 1; gray shale 7
139	386		292	94	Gray shale 9; black shale 1	4	0	Underclay 2; gray shale 2; limestone 1
			313	73	Gray shale 11; black shale 1	4	0	Underclay 2; limestone 1
			320	64	Underclay 2; limestone 1	4	0	Underclay 4; siltstone 12
			364	22	Gray shale 6; black shale 3	5	0	Underclay 3; siltstone 13
			537	−151	Siltstone and shale 11; black shale 1	4	0	Underclay 1; gray shale 12
			858	−472	Gray shale 78; black shale 1	3	0	Underclay 1; gray shale 13
		6	925	−539	Limestone 3; shale 3; black shale 1	5	0	Underclay 2; limestone 4
46	451		767	−316	Siltstone 10; black shale 1	3	0	Gray shale 10
			935	−484	Gray shale 33; black shale 1	3	0	Siltstone 4; gray shale 12
		6	992	−541	Siltstone 14; coal 1; limestone 4	4	0	Underclay 2; sandy shale 8
		5	1092	−641	Sandstone 22	6	0	
65	379	6	904	−525	Limestone 4; black shale 2	5	0	Gray shale 7; sandstone 6
98	444		991	−547	Gray shale 10; black shale 3	4	0	Underclay 1; gray shale 6
		6?	1076	−632	Sandstone 18	3	0	Underclay 1; sandstone 6
81	410	6	926	−516	Limestone 4; black shale 1	4	0	Underclay 1; sandstone 9
					White County			
138	424		702	−278	Gray shale 92	4	0	Underclay 1; siltstone 27
		6	754	−330	Limestone 7; black shale 1	4	0	Underclay 3; gray shale 3
		5	834	−410	Gray shale 13; black shale 1	4	0	Underclay 1; limestone 2
31	385		835	−450	Gray shale 6; black shale 2	3	0	Underclay 3; sand and shale 9
		6	942	−557	Gray shale 12; black shale 2	5	0	Underclay 2; sandstone 29
		5	1013	−628	Sandstone 23; black shale 1	3	0	Sandstone 23
		4?	1092	−707	Gray shale 11; black shale 1	2	6	Gray shale 6; sandstone 22
		2?	1132	−747	Gray shale 5; black shale 2	4	0	Underclay 1; sandy shale 8
		DK?[d]	1189	−804	Sandstone 28; black shale 1	4	0	Sandstone 34
86	380	6	786	−406	Siltstone 16; black shale 1	4	6	Underclay 1; sandstone 8

[a] Drill-cuttings studied in field only.
[d] DeKoven coal.

TABLE 3.—(Concluded)

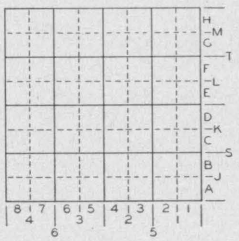
Map No. (Fig. 12)	Surface elevation (Instrumental) Datum sea-level	Coal No.	Depth to top coal bed ft.	Elevation top coal bed Datum sea-level ft.	SEDIMENTARY SUCCESSION Based on laboratory study of drill-cuttings		
					Above coal bed (thickness in ft.)	Coal bed ft.	in.	Below coal bed (thickness in ft.)
White County—(Concluded)								
106	431	6?	882	−451	Limestone 4; black shale 2	3	0	Underclay 1; siltstone 28
131	440	6?	1065	−625	Limestone 7; black shale 1	3	0	Underclay 1; sandstone 20
28	378		318	60	Gray shale 8; black shale 1	4	0	Gray shale 16
			767	−389	Gray shale 44; black shale 3	3	0	Gray shale 2; coal and shale 6
		6	806	−428	Limestone 5; black shale 1	8	0	Underclay 2; gray shale 6
36	421		479	−58	Gray shale 49; black shale 1	2	6	Gray shale 11
		6	885	−464	Gray shale 6; limestone 4	5	0	Underclay 2; gray shale 3
		5	988	−567	Limestone 1; gray shale 6	3	6	Underclay 1; gray shale 14
85	398	4	938	−540	Gray shale 64; black shale 1	2	6	Underclay 1; gray shale 4
		2	984	−586	Siltstone 37; black shale 1	5	0	Underclay 2; siltstone 1; shale 8
		DK?[d]	1072	−674	Siltstone 32; black shale 1	3	0	Underclay 1; siltstone 30
		Dav.[e]	1108	−710	Siltstone 30; black shale 1	3	0	Underclay 1; gray shale 8
29	393	6	970	−577	Limestone 2; shale 2; black shale 1	4	0	Underclay 1; sandstone 4; limestone 10
		5?	1054	−661	Gray shale 4; limestone 1; black shale 2	4	0	Underclay 1; gray shale 80
		4?	1170	−777	Sandy shale 25	4	0	Underclay 1; gray shale 32
		DK?[d]	1264	−871	Sandstone and shale 24	4	0	Sandstone and shale 30
126	371	6	750	−379	Limestone 6; black shale 1	3	6	Underclay 1; sandstone 18
		5	823	−452	Siltstone and sandstone 6; black shale 1	4	0	Underclay 3; limestone 6
		4?	953	−582	Gray shale 4; black shale 1	3	0	Underclay 1; siltstone 3
			1098	−727	Sandstone 42	5	0	Underclay 1; siltstone 8
74	404	6	620	−216	Shale and limestone 14; limestone 4	6	0	Underclay 1; siltstone 6
		5	701	−297	Shale 15; black shale 2	6	0	Underclay 4; sandstone 10
132[a]	443		296	147	Gray shale 6; black shale 1	3	0	Underclay 5; gray shale 15
			770	−327	Gray silty shale 19; black shale 1	3	0	Gray shale 16
		5	836	−393	Limestone 2; black shale 1	5	0	Underclay 2; shale and limestone 10
		5	924	−481	Sandy shale 13; black shale 1	4	6	Underclay 2; shale and limestone 10

68	395±	5?	861		Siltstone 10; black shale 1	5	0	Underclay 2; gray shale 6
76	348	6	482	−134	Limestone 5; black shale 1	5	0	Underclay 1; sandstone 22
		5	578	−230	Shale 43; limestone 1; black shale 2	4	0	Sandy shale 18
44	350	6	424	−74	Gray shale 5; limestone 5	5	0	Gray shale 1; sandstone 10
		5	530	−180	Gray shale 32; black shale 1	5	0	Underclay 1; gray shale 64
		4?	598	−248	Gray shale 64	2	6	Gray shale 2; limestone 2
			799	−449	Gray shale 6	4	0	Underclay 1; limestone 4

[a] Drill-cuttings studied in field only.
[b] Black shale includes black "slate."
[c] Siltstone is a very fine-grained sandstone.
[d] DeKoven coal
[e] Davis coal.
[f] Friendsville coal.
[g] Topographic map estimate.

EXPLANATION OF ABBREVIATIONS USED IN TABULATED DATA

Location.—Location in section by numbers and letters; see plat below:



County number.—The county number is given on map except for those numbers preceded by an asterisk (*). Each county has its own series of numbers.

Type of hole.—All holes were drilled by rotary-drill except those indicated by the following symbols:
CH—Churn-drill
PT—Oil test by churn-drill
DD—Diamond-drill

Logs available for examination at the offices of the Survey.

Surface altitude.—Altitude of the surface above sea level is given in feet. The method for determining altitude of top of hole, shaft, etc., is as follows:
B—Barometer
C—Company information
G—Ground level estimate; probably accurate within 5 feet
H—Hand-level
P—Plane-table
T—Topograhpic map estimate not in field
Y—Wye level or transit

Total depth.—The total depth of hole is given to nearest foot.

Year drilled.—The year of drilling is given by the last two figures only; "26" means "1926."

Doubtful information.—A notation here indicates that although information is available, the accuracy of some part of the data is in doubt. The nature of the doubt is shown by number, as follows:
2—Correlation of coal bed; a, No. 6; b, No. 5
3—Exact location
4—Surface altitude

Coal No. 6 and No. 5.—Depth to coal is given to the top of bed to the nearest foot. Altitude to the top of the coal bed is given in feet above or below sea level. Thickness is given in feet. *0 indicates coal bed is eroded or is absent at its usual horizon. Where no coal data are given, the information is unreliable or hole did not reach the coal bed. Where altitude is shown but not depth, the altitude is estimated from other data.

APPENDIX A

TABULATED DRILL-RECORD DATA FOR MILLERSVILLE LIMESTONE

IN

COLES, CUMBERLAND, EFFINGHAM, FAYETTE, JASPER,
MOULTRIE, AND SHELBY COUNTIES

(PLATE 2)

BY

EARLE F. TAYLOR

Location			County number[a]	Type of hole	Operator, farm, farm number	Surface elev., ft. Datum sea-level	How determined	Total depth, ft.	Year drilled	Millersville		
T.	R.	Sec.								Depth, ft.	Altitude, ft.	Thickness, ft.
					Coles County							
11N	7E	1–B8	1		Carter Oil Co.—Akers, 1	746	C	1885	39	500	246	25
		1–E8	2		Wheeles Whisenant—Michaels, 1	762	C	2173	38	510	252	25
		2–E1	3		Wheeles, et al—Michaels, 2	763	G	3307	39	510	253	20
		10–H1	4		Carter Oil Co.—Ohm, 1	737	C	2125	40	460	277	25
		11–H4	5		Bragassa and Billings—Trogden, 1	734	C	2114	40	495	239	25
		16–H2	6		Williams—Alexander, 1	672	C	2352	41	508	164	34
11N	10E	21–A1	10		Kingwood Oil Co.—Tomberlin, 1	592	T	3542	38	72	520	30
		24–C5	12		Daugherty and Dunn—Mitchel, 1	635	G	680	39	120	515	30
12N	7E	9–E1	13		Thompson Drilling Co.—Degler, 1	695	G	2277	38	557	138	30
		14–B2	15	CH		725	T	1111	..	475	250	37
		26–A4	17		Carter Oil Co.—Pinnell, 1	743	G	2107	40	448	295	26
		35–C5	19		Carter Oil Co.—Seaman, 1A	760	C	2027	40	475	285	26
		35–D6	18		Carter Oil Co.—Seaman, 1	760	C	4908	40	465	295	30
12N	8E	12–H4	21		Dee Bros.—James, 1	669	C	2356	39	610	59	30
12N	9E	10–A8	22	PT	McCurdy, et al.—Jodry, 1	686	C	595	25	560	126	35
		21–F7	23	PT	Eke.—Walters, 1	608	C	1050	35	510	98	15
12N	10E	2–C8	25	PT	Schrider Oil Co.—Houghton, 1	625	B	1835	26	...	...	*0
		21–A2	26	PT	McBride, Inc.—Galbreath, 1	643	C	1037	33	110	533	55
13N	7E	2–B4	31		Carter Oil Co.—Moore Heirs, 1	654	C	1912	41	395	259	30
		2–B5	30		Carter Oil Co.—Haybrook, 1	651	C	1840	41	386	265	34
		10–A3	32		Carter Oil Co.—Cobb, 1	667	C	3226	40	411	256	36
		11–H5	33		Carter Oil Co.—Hamilton, 1	666	C	1873	42	425	241	
		22–C3	34		Texas Co.—Tracy, 1	673	G	3220	39	432	241	28
13N	8E	30–C2	35		Kingwood Oil Co.—Tivnen, 1	689	G	3399	39	515	174	40
13N	9E	1–L3	36	PT	Wabash Gas Co.—James, 1	666	H	2734	13	...	...	*0
		27–E4	37		Hughes—Swango, 1	680	B	905	38	...	...	*0
		36–A8	38	PT	"Tex" Harvey Oil Co.—Irwin, 1	667	T	750	40	...	...	*0
13N	10E	13–D3	39	PT	Humphries—Humphries, 1	675	C	974	41	...	...	*0
		18–E2	40	PT	McBride, Inc.—Craig, 1	677	T	1263	24	...	...	*0
		19–A5	41	PT	McBride, Inc.—Chambers, 1	694	T	1040	24	...	...	*0
					Cumberland County							
9N	7E	7–D5	6		Marshall and Sims—Baker, 1	644	C	2487	39	451	193	41
9N	9E	17–F1	7		National Consumers Oil Co.—Ward, 1	576	G	2080	38	560	16	35
		26–G5	8		Fisher and Jackson—Coble, 1	592	T	2825	38	587	5	25
		29–H4	9		Union Producers Pet. Co.—Cox, 1	512	G	4112	39	475	37	20
9N	10E	14–D6	12		Pet. Exploration Co.—McFarlin, 1	604	B	1532	30	145	459	21
10N	7E	15–E8	13		Doran—Haskett, 1	662	G	2060	39	414	248	56
		18–A5	1		McClory and Henshaw—Rhea, 1	652	G	2301	38	410	242	35
		21–H7	5		Jarvis Bros.—Wilson, 1	659	G	2327	39	454	205	32
10N	8E	16–F7	3	PT	Central Illinois Pet. Co.—Dobbs, 1	610	B	2835	23	500	110	..
		24–H2	4	PT	Arthur Oil Co.—Furray, 1	598	B	760	27	550	48	40

[a] County number in *italics* indicates hole logged by Survey field party.

Location			County number[a]	Type of hole	Operator, farm, farm number	Surface elev., ft. Datum sea-level	How determined	Total depth, ft.	Year drilled	Millersville		
T.	R.	Sec.								Depth, ft.	Altitude, ft.	Thickness, ft.
Cumberland County—(Concluded)												
10N	9E	4–B5	*26*	...	Milo Ritchie, Greeson, 1	609	G	....	42	553	56	33
		29–A1	14	...	Jeffries and Cobb—Miller, 1	580	T	2678	38	545	35	28
		30–G1	15	...	Jolly, et al—Jenkins, 1	578	C	2330	38	560	18	18
10N	10E	16–B4	21	PT	.....—Roby, 1	570	B	825	27	240	330	35
		22–C4	22	...	Ginther—Kemper, 1	620	C	712	40	180	440	28
		36–H3	23	PT	Myers	625	B	905	23	...	...	*0
11N	7E	25–E1	24	PT	Willson—Wilson, 1	668	B	920	6	500	168	40
11N	8E	27–G5	25	...	Phillips Pet. Co.—Ozee, 1	647	G	2412	38	579	68	..
Effingham County												
8N	4E	5–F8	21	...	Ervin—Anderson, 1	550	G	1668	41	175	375	62
		6–C8	22	...	Carter Oil Co.—Steele, 1	569	P	1526	42	125	445	40
		7–C7	24	...	Troop, Heyl, et al—Lecrone, 2	609	P	1645	40	150	459	25
		7–D8	23	...	Troop, et al—Lecrone, 1	601	B	1551	40	155	446	18
		7–F8	25	...	Carter Oil Co.—Workman, 1	597	G	1566	41	161	436	49
		17–D2	26	...	Clow, et al—Johnston, 1	612	C	1771	40	200	412	20
		18–B8	29	...	Hardy, et al—Morehead, 1	614	C	1696	39	160	454	40
		18–G8	31	...	Carter Oil Co.—Reed, 1	592	C	1544	41	140	452	25
		18–H2	28	...	Carter Oil Co.—Lilly, 1	610	C	1616	40	142	468	82
		18–H8	32	...	Carter Oil Co.—Tipsword, Homan, 1	568	C	1511	41	120	448	45
		24–H6	33	...	Penn. Ill. Oil and Gas Corp.—Neihoff, 1	625	C	2700	38	290	335	65
8N	6E	16–D4	44	...	Doran—Dasenbrock, 1	607	C	2553	41	489	117	19
		18–B5	45	...	Kingwood Oil Co.—Koester, 1	600	B	2568	39	478	122	12
		23–G8	46	...	Whisenant and Trenchard—Weber, 1	597	G	2509	39	443	154	17
		35–F1	47	...	Hebert and Smith—Kroeger, 1	586	C	2660	42	440	146	20
8N	7E	11–E4	48	...	Carter Oil Co.—Pruener, 1	596	C	2660	37	499	97	9
		16–E8	49	...	Kremer—Ordner, 1	607	B	1830	..	495	112	30
		31–E5	*50*	...	Phillips Pet. Co.—Overbeck, 1	584	G	2853	39	437	147	14
9N	4E	19–A1	35	...	Carter Oil Co.—Richards, 1	623	P	2027	41	183	440	50
		20–A2	36	...	Carter Oil Co.—Bartscht, 1	612	B	2012	38	210	402	42
		30–A8	37	...	Peyton and McGraw—Beck, 1	627	P	1707	40	156	471	44
		31–A6	41	...	Carter Oil Co.—S. C. Tennery, 1	614	B	1656	38	155	459	47
		31–B8	38	...	Carter Oil Co.—Buzzard, 1	604	P	1555	41	135	469	40
		31–C6	40	...	Carter Oil Co.—J. N. Tennery, 1	618	G	1694	41	140	478	45
		31–H1	39	...	Goad, et al—Henry, 1	608	Y	1716	40	160	448	35
9N	6E	26–D2	57	...	Mitchell, et al—Zambahlen, 1	622	B	2656	40	476	146	..
		28–A5	43	...	Washburn and Powers—Lohman, 1	612	G	2466	42	440	172	..
Fayette County												
8N	3E	1–B4	180	...	Carter Oil Co.—Miller, 1	554	G	1487	41	85	469	45
		1–B7	178	...	Carter Oil Co.—Hoffman, 1–7	598	G	1659	41	113	485	41
		1–C4	179	...	Carter Oil Co.—Miller, 2	592	G	1525	41	127	465	43
		1–F2	177	...	Carter Oil Co.—Giles, Miller, 1–4	569	G	1528	41	112	457	41
		1–G6	181	...	Carter Oil Co.—St. Pierre, 1–3	616	G	1546	40	130	486	39
		2–B3	183	...	Carter Oil Co.—Buesking, 2–8	604	G	1588	39	110	494	44
		2–C5	184	...	Carter Oil Co.—McCollum, 1	602	G	1585	39	107	495	45
		2–F3	185	...	Carter Oil Co.—Sinclair, 2–4	619	G	1610	40	133	486	42
		2–G6	182	...	Carter Oil Co.—Algood, 2–3	601	G	1635	41	138	463	22
		3–A2	189	...	Carter Oil Co.—Holman, 1	602	B	1515	40	125	477	38

[a] County number in *italics* indicates hole logged by Survey field parties.

Location T.	R.	Sec.	County number[a]	Type of hole	Operator, farm, farm number	Surface elev., ft. Datum sea-level	How determined	Total depth, ft.	Year drilled	Millersville Depth, ft.	Millersville Altitude, ft.	Millersville Thickness, ft.
Fayette County—(Continued)												
3	A	3	186	...	Carter Oil Co.—Alsop, 1	609	G	1607	40	140	469	34
3	B	1	190	...	Carter Oil Co.—Holman, 2	598	G	1608	41	115	483	30
3	G	1	187	...	Carter Oil Co.—Buzzard, 1	600	G	1533	41	125	475	31
3	H	2	188	...	Carter Oil Co.—Buzzard, 2	602	G	1538	41	130	472	45
9	A	2	192	...	Carter Oil Co.—Miller, 2	606	G	1523	41	140	466	25
9	A	7	191	...	Cooper, et al—Hogge, 1	553	G	1652	40	127	426	30
9	B	1	193	...	Carter Oil Co.—Miller, 1	607	G	1596	40	140	467	40
9	C	1	194	...	Carter Oil Co.—Sickler, 3	598	G	1591	40	142	456	26
10	C	3	195	...	Carter Oil Co.—Fortner, 10–8	615	G	1598	39	140	475	53
10	C	5	197	...	Carter Oil Co.—State Bank, 3	626	G	1609	39	155	471	35
10	E	6	198	...	Carter Oil Co.—Wood, 1	608	G	1601	40	140	468	40
10	G	4	196	...	Carter Oil Co.—Lancaster, 1	612	G	1539	41	137	475	28
11	C	2	202	...	Carter Oil Co.—Matson, 11–8	537	G	1524	39	55	482	15
11	C	7	200	...	Carter Oil Co.—Larimore, 11–7	603	G	1586	39	150	453	40
11	F	8	203	...	Carter Oil Co.—Wetmore, 1	606	C	1601	38	130	476	25
11	G	2	199	...	Carter Oil Co.—Larimore, 11–4	553	G	1541	39	86	467	24
12	B	7	206	...	Carter Oil Co.—Steed, 12–7	600	G	1546	40	118	482	62
12	C	4	209	...	Carter Oil Co.—Taylor, 4	600	G	1528	40	130	470	50
12	E	3	205	...	Carter Oil Co.—Drees, 2	607	B	1545	40	140	467	44
12	E	6	207	...	Carter Oil Co.—Taylor, 1	604	G	1542	39	120	484	30
12	F	7	204	...	Carter Oil Co.—Alsop, 12–3	539	G	1468	40	39	500	43
13	B	4	210	...	Carter Oil Co.—Gregg, 1	596	G	1539	40	160	436	40
13	B	7	212	...	Carter Oil Co.—Kagay, Grames, 13–7	592	G	1525	40	158	434	38
13	D	3	211	...	Carter Oil Co.—Gregg, 3	599	G	1537	40	159	440	22
13	E	6	214	...	Carter Oil Co.—Doty, 1	585	G	1518	40	115	470	60
13	F	4	215	...	Carter Oil Co.—Tipsword, 1	572	G	1517	40	125	447	60
14	B	3	216	...	Carter Oil Co.—Kline, 2	599	G	1532	38	171	428	55
14	C	7	218	...	Carter Oil Co.—Hopper, 14–7	602	G	1590	39	130	472	50
14	F	3	217	...	McBride, Inc.—Stokes, 3A	593	G	1660	38	155	438	50
14	F	7	219	...	Carter Oil Co.—Hopper, 14–3	605	G	1593	39	130	475	57
15	B	4	222	...	Carter Oil Co.—Main, 2	597	G	1552	38	135	462	20
15	D	7	223	...	Carter Oil Co.—Wood, 2	581	G	1544	38	96	485	41
15	F	2	220	...	Carter Oil Co.—Bartimus, 1	535	C	1498	38	81	454	53
15	G	6	221	...	Carter Oil Co.—Dove, 15–3	630	G	1598	38	127	503	38
16	A	5	224	...	Whisenant and Trenchard—Lilly, 11	614	C	1578	39	112	502	38
16	B	3	225	...	Whisenant and Trenchard—Lilly, 14	636	C	1511	39	125	511	35
16	C	6	228	...	Carter Oil Co.—Lilly, 3	600	G	1588	39	98	502	52
16	D	4	226	...	Whisenant and Trenchard—Lilly, 22	620	C	1584	40	102	518	41
16	E	7	227	...	Carter Oil Co.—Lilly, 1	590	G	1602	39	90	500	60
16	G	3	229	...	Carter Oil Co.—Miller, 1	611	G	1614	39	135	476	29
17	A	1	230	...	Carter Oil Co.—Lilly, 1	605	B	1594	40	149	456	8
17	B	1	231	...	Carter Oil Co.—Lilly, 2	602	G	1600	41	128	474	27
19	A	5	232	...	McBride, Inc.—Stokes, 1B	589	G	1757	38	155	434	20
20	A	1	236	...	Carter Oil Co.—Wright, 4	575	G	1563	39	70	505	28
20	B	3	237	...	Carter Oil Co.—Wright, 9	580	G	1568	39	70	510	25
20	B	5	233	...	Carter Oil Co.—Eagleton, 3	587	G	1577	39	91	496	20
20	E	3	234	...	Carter Oil Co.—Knapp, 1	546	C	1539	41	55	491	27
20	G	1	235	...	Carter Oil Co.—Scott, 1	604	G	1594	41	115	489	25
21	B	2	239	...	Carter Oil Co.—Brauer, 21–8	557	G	1532	39	65	492	28
21	C	7	238	...	Carter Oil Co.—Boles, 21–7	570	G	1550	39	55	515	30

[a] County number in *italics* indicates hole logged by Survey field party.

Location T.	R.	Sec.	County number[a]	Type of hole	Operator, farm, farm number	Surface elev., ft. Datum sea-level	How determined	Total depth, ft.	Year drilled	Millersville Depth, ft.	Millersville Altitude, ft.	Millersville Thickness, ft.
					Fayette County—(Continued)							
21	F	2	242	...	Carter Oil Co.—Presbyterian Church, 3	662	G	1630	39	155	507	30
21	F	7	240	...	Carter Oil Co.—Hedges, 2	615	G	1580	40	115	500	20
21	H	2	241	...	Jarvis Bros.—Mize, 2	665	G	1610	38	160	505	35
22	C	4	245	...	Carter Oil Co.—Myers, 1	527	G	1510	39	50	477	35
22	C	6	244	...	Carter Oil Co.—Hopper, 22–7	528	G	1504	39	40	488	75
22	G	2	246	...	Carter Oil Co.—Williams, 22–4	571	G	1559	39	100	471	62
22	G	7	243	...	Carter Oil Co.—Drees, 22–3	531	G	1501	39	40	491	40
23	A	7	250	...	Carter Oil Co.—Rhodes, 2	530	G	1530	40	75	455	7
23	C	4	248	...	Carter Oil Co.—Brooks, 2	556	G	1556	40	110	446	40
23	F	1	249	...	Carter Oil Co.—Dragoo, 2	599	G	1544	40	165	434	35
23	F	6	247	...	Carter Oil Co.—Bauer, Smith, 23–3	600	G	1588	39	164	436	34
24	B	8	252	...	Carter Oil Co.—Graves, 1	537	G	1547	40	60	477	25
24	E	7	253	...	Carter Oil Co.—Purtilar School Trustees, 2	597	G	1670	41	146	451	32
24	G	5	254	...	Carter Oil Co.—Workman, 3	610	G	1643	41	149	461	41
24	H	7	251	...	Carter Oil Co.—Grames, 2	603	G	1532	40	165	438	33
26	A	8	257	...	Stewart Oil Co.—Rhodes, 1	610	C	1617	39	130	480	21
26	D	7	258	...	Stewart Oil Co.—Rhodes, 2	610	C	1613	40	127	483	27
26	G	8	256	...	Carter Oil Co.—Rhodes, 4	602	G	1605	40	127	475	28
26	H	6	255	...	Carter Oil Co.—Logue, 5	602	G	1613	40	125	477	37
27	A	2	263	...	Babcock—J. L. Rhodes, 6	609	C	1614	40	117	492	27
27	B	1	262	...	Babcock—Rhodes, 4	608	C	1584	40	116	492	26
27	B	3	261	...	Babcock—E. Rhodes, 6	592	C	1593	40	115	477	24
27	B	7	259	...	Carter Oil Co.—Durbin, 1	603	B	1593	39	155	448	30
27	G	7	260	...	Carter Oil Co.—Hogan, 27–3	588	G	1576	39	110	478	30
27	H	2	264	...	Carter Oil Co.—Rhodes, 2	573	G	1561	39	110	463	19
28	C	1	269	...	Carter Oil Co.—Zetsche, 2	598	G	1587	39	120	478	20
28	C	5	267	...	Carter Oil Co.—Marshall, 3	608	G	1581	39	140	468	20
28	D	3	265	...	Carter Oil Co.—Blankenship, 1	605	G	1593	39	135	470	26
28	G	1	266	...	Carter Oil Co.—Durbin, 1	527	G	1520	39	44	483	21
28	H	7	268	...	Carter Oil Co.—Weaber, 3	531	G	1490	39	18	513	30
29	B	6	271	...	Carter Oil Co.—Kimbrell, 2	556	G	1521	39	70	486	10
29	C	3	270	...	Carter Oil Co.—Birdie, 4	564	G	1542	39	65	499	15
29	F	2	275	...	Carter Oil Co.—Raymond, 1	522	G	1492	38	20	502	30
29	G	5	272	...	Jarvis Bros.—Sinclair, 5	565	G	1530	38	65	500	17
29	G	6	273	...	Jarvis Bros.—Sinclair, 6	605	G	1590	38	125	480	27
29	H	6	274	...	Jarvis Bros.—Sinclair, 15	604	G	1510	39	102	503	30
30	A	1	277	...	Carter Oil Co.—Tucker, 3	573	G	1563	39	85	488	25
30	E	1	276	...	Carter Oil Co.—Botterbusch, 3	520	B	1483	40	60	460	30
30	F	1	278	...	Carter Oil Co.—Sherman, 4	593	G	1591	41	140	453	10
31	A	5	281	...	Wilson, Markham, et al—Emerson, 1	597	B	1514	39	127	470	15
31	A	6	283	...	Mabee and Co.—Kepp, 3	606	G	1637	38	147	459	14
31	A	8	284	...	Mabee Oil and Gas—Kepp, 5	606	G	1582	40	148	458	15
31	C	3	285	...	Dunn and Daly—McCann, 3	608	C	1598	40	130	478	13
31	D	5	282	...	Mabee Drilling Co.—Kepp, 1	606	G	1637	38	138	468	17
31	E	1	279	...	Carter Oil Co.—Brown, 7	604	G	1590	39	130	474	9
31	H	1	280	...	Carter Oil Co.—Brown, 3	604	G	1550	38	128	476	7
32	B	3	290	...	Carter Oil Co.—McClain, 2	597	G	1580	39	115	482	15
32	B	6	286	...	Magnolia Pet. Co.—Clow, 2	588	G	1575	38	103	485	13
32	F	2	289	...	Carter Oil Co.—Ireland, 4	571	G	1564	39	93	478	12
32	G	6	287	...	Doran—Goetting, 2	597	G	1584	38	120	477	13

[a] County number in *italics* indicates hole logged by Survey field party.

Location			County number[a]	Type of hole	Operator, farm, farm number	Surface elev., ft. Datum sea-level	How determined	Total depth, ft.	Year drilled	Millersville		
T.	R.	Sec.								Depth, ft.	Altitude, ft.	Thickness, ft.
					Fayette County—(Concluded)							
		32–G8	288	...	Doran—Goetting, 6	605	G	1552	38	120	485	7
		32–H2	291	...	Carter Oil Co.—McCloy, 1	572	G	1561	39	80	492	30
		33–B2	295	...	Minerva Oil and Magnolia Pet. Cos.—Tish, 9	592	C	1571	41	129	463	12
		33–C7	294	...	Carter Oil Co.—Taylor, 4	602	G	1590	40	138	464	16
		33–D4	296	...	Minerva Oil Co.—Tish, 11	599	G	1547	40	134	465	18
		33–F3	292	...	Carter Oil Co.—Dial, 7	598	G	1586	40	145	453	25
		33–F8	293	...	Carter Oil Co.—Ireland, 8	595	G	1578	39	120	475	25
		34–D8	302	...	Carter Oil Co.—Taylor, 4	599	G	1587	39	130	469	25
		34–F1	301	...	Stewart Oil Co.—McCloy, 4	610	C	1596	39	126	484	27
		34–G2	299	...	Stewart Oil Co.—McCloy, 1	608	C	1597	39	129	479	24
		34–G4	298	...	Stewart Oil Co.—Logue, 2	595	C	1577	39	108	487	13
		34–G7	297	...	Carter Oil Co.—Dial, 2	604	G	1599	39	145	459	30
		34–H1	300	...	Stewart Oil Co.—McCloy, 2	604	C	1587	39	125	479	24
9N	3E	34–A2	306	...	Carter Oil Co.—Buzzard, 4	608	G	1534	41	136	472	34
		34–B1	305	...	Carter Oil Co.—Buzzard, 3	601	G	1528	41	130	471	30
		34–C2	303	...	Lacy—Buzzard, 1	611	C	1662	38	138	473	44
		34–E1	304	...	Truitt—Buzzard, 1	610	G	1619	41	130	480	46
		35–A3	307	...	Stewart Oil Co.—Gordon, 1	618	C	1586	40	137	481	31
		35–B1	308	...	Stewart Oil Co.—Gordon, 4	618	G	1548	40	138	480	34
		35–C2	310	...	Carter Oil Co.—Baker, 35–8	611	G	1660	41	142	469	26
		35–C2	311	...	Carter Oil Co.—Sloan, 1	609	G	1539	41	136	473	31
		35–G6	309	...	Allied Oil Prod. Co.—Buzzard, 1	601	C	1590	40	114	487	62
		36–A4	313	...	Carter Oil Co.—St. Pierre, 1–2	615	G	1671	41	152	463	36
		36–B1	317	...	Carter Oil Co.—Miller, 2	603	G	1551	41	135	468	42
		36–B5	314	...	Carter Oil Co.—St. Pierre, 8	630	G	1574	41	160	470	42
		36–E2	312	...	Carter Oil Co.—Huffman and Fulks, 1	631	G	1696	41	152	479	6
		36–E6	316	...	Whisenant and Henshaw—Zanders, 1	625	B	1672	38	140	485	41
		36–G8	315	...	Carter Oil Co.—Wills, Gordon, 2	612	G	1555	41	132	480	45
					Jasper County							
8N	8E	21–E7	1	PT	Braun—Crews, 1	600	T	1807	14	520	80	11
		24–H8	2	...	Weinert, Inc.—Isley, 1	585	C	3504	37	532	53	12
8N	9E	4–B8	3	...	Robey Drilling Co.—Whalen, 1	569	C	2728	39	540	29	12
8N	10E	7–C6	4	...	Thompson Drilling Co.—Bowers, 1	579	C	2776	39	570	9	17
		9–E3	5	...	Johnson Oil Refining Co.—Huddlestun, 1	565	C	2557	41	485	80	5
		14–A5	6	...	Thompson Drilling Co.—Union Central Life Insurance Co., 1	567	C	2601	39	436	131	4
		17–A4	7	...	Johnson Oil Refing. Co.—Mendenhall, 1	548	C	2607	40	500	48	9
					Moultrie County							
13N	4E	2–H5	5	PT	—Davis, 1	585	T	2150	23	240	345	40
13N	5E	29–E2	8	...	Seaboard Oil Co.—Horn, 1	644	G	3262	39	340	304	25
13N	6E	9–B3	6	...	Seaboard Oil Co.—Purvis, 1	612	G	1950	39	375	237	20
		18–G4	7	...	Neely, et al—Shuman	644	G	2005	38	380	264	25
14N	4E	31–H4	4	...	Olson Drilling Co.—Ekiss, 1	675	C	2947	41	200	475	35
					Shelby County							
9N	3E	9–B1	33	...	Baker Fields—Garrett, 1	589	G	2008	38	193	396	45
9N	4E	1–G5	84	...	Kingwood Oil Co.—Vogel, 1	617	B	2129	38	280	337	50
		4–H7	32	...	Moore and Black—Yakey, 1	539	B	1678	39	151	388	39
		5–A7	69	...	Carter Oil Co.—Leach, 1	604	G	2055	41	186	418	54

[a] County number in *italics* indicates hole logged by Survey field party.

Location			County number[a]	Type of hole	Operator, farm, farm number	Surface elev., ft. Datum sea-level	How determined	Total depth, ft.	Year drilled	Millersville		
T.	R.	Sec.								Depth, ft.	Altitude, ft.	Thickness, ft.
					Shelby County—(Concluded)							
9N	5E	3–A7	24	...	Kingwood Oil Co.—Trueblood, 1	630	G	3515	39	296	334	49
		3–F3	22	PT	Schultz	629	P	970	..	290	339	..
		7–B4	25	PT	Aylward—Bickford, 1	638	B	1974	39	251	387	57
9N	6E	12–H6	26	...	Boeseke and Goldman—Bigler, 1	642	C	2405	39	435	207	41
		15–H1	27	...	Boeseke—Zumbahlen, 1	639	C	2416	39	420	219	22
10N	3E	5–E6	50	...	Wiser Oil Co.—Smith, 1	631	G	1805	41	204	427	50
		7–E4	51	...	Oil Incorporated—Barkhurst, 1	621	G	1697	41	168	453	42
		7–E8	63	...	Luttrell—Horsman, 1	643	C	1749	42	224	419	34
		7–F1	57	...	Guild—Hunter, 1	635	C	1740	41	195	440	45
		30–E4	64	PT	Moore—Moore, 1	565	G	1936	41	155	410	55
10N	4E	7–A1	65	...	Kingwood Oil Co.—Howe, 1	583	B	2544	39	160	423	50
		8–A5	*66*	...	Illinois Exploration Co.—Davis, 1	606	C	1953	42	189	417	35
		19–A1	31	...	Whisenant and Henshaw—Mckittrick, 1	608	C	2012	38	220	386	50
		22–H3	70	...	Doran—Compton, 1	623	B	2015	40	260	363	30
		25–D3	5	PT	Ginther—Prosser, 1	621	P	2940	..	240	381	45
		28–E6	72	...	Carter Oil Co.—Storm, 1	606	G	2285	41	222	384	32
		33–E6	74	...	Doran and Yakey—Gallegher, 1	589	C	2005	40	200	389	31
10N	5E	3–H8	75	...	Fisher and Jackson—Von Behren, 1	630	G	1938	38	300	330	60
		22–A4	76	...	Powell, et al—Rincker, 1	636	B	2138	40	284	352	44
		23–E5	77	...	Doran—Fritz, 1	637	G	1945	40	300	337	30
		27–H4	78	...	Johnson Drilling Co.—Chaffee, 1	639	G	1964	40	284	355	41
		27–H4	79	...	Aylward—Wabash R.R., 1	641	C	1969	39	285	356	42
		34–H6	80	...	Adams and Gaskey—Fluga, 1	646	C	1992	39	315	331	40
10N	6E	14–E1	30	...	English, et al—McClory, 1	657	H	2382	37	435	222	25
		18–H6	82	...	Pray—Russell Estate, 1	625	G	2049	40	360	265	29
		20–F8	83	...	Gulf Refining Co.—Best, 1	626	G	2330	39	315	311	45
		20–H6	19	PT	Kingman Oil Co.	637	P	1176	13	335	302	55
11N	3E	4–A1	85	...	Milan, et al—Kull, 1	616	B	1951	38	220	396	30
		21–F5	*98*	...	Sims—Bauer, 1	624	G	....	42	175	449	39
11N	4E	8–A5	4	PT	Eddy—Eddy, 1	563	P	1535	7	180	383	55
		18–G3	3	DD	Shelby County and Natural Gas Co.	548	P	1117	87	173	375	41
		22–D1	87	...	Ohio Oil Co.—Elliott, 1	651	G	2091	41	268	383	17
11N	5E	30–E1	88	...	Connel—Jading, 1	639	G	1865	38	285	354	41
11N	6E	3–H7	89	PT	Myers—Storm, 1	720	T	1202	32	440	280	45
12N	3E	6–A4	90	...	Zephyr Drilling Co.—Holmes, 1	647	C	1803	39	193	454	40
12N	4E	17–G1	92	...	Kingwood Oil Co.—Staley, 1	680	B	2072	38	310	370	35
		34–A7	93	...	Prunty Production Co.—Hickey, 1	655	B	2013	38	290	365	..
13N	3E	12–A1	96	...	Olson Drilling Co.—Atkinson, 1	664	G	2960	41	219	445	46
		36–G8	97	...	Brunsvold—Yantis, 1	671	C	3046	41	253	418	33
13N	4E	32–A4	18	PT	Eddy—Brady, 1	673	P	1352	..	275	398	..

[a] County number in *italics* indicates hole logged by Survey field party.

APPENDIX B

TABULATED DRILL-RECORD DATA FOR LIMESTONE AND COAL

In Wayne County
(Plates 4 and 5)

For explanation of abbreviations used in tabulated data, see page 64.

Location T., R., sec.	County number[a]	Type of hole	Operator	Surface elev., ft.	Datum sea-level How determined	Total depth, ft.	Year drilled	Doubtful information	Coal No. 6 Depth, ft.	Coal No. 6 Altitude, ft.	Coal No. 6 Thickness, ft.	Coal No. 5 Depth, ft.	Coal No. 5 Altitude, ft.	Coal No. 5 Thickness, ft.	"Shoal Creek" Limestone Depth, ft.	"Shoal Creek" Limestone Altitude, ft.	"Shoal Creek" Limestone Thickness, ft.
Wayne County																	
1N 5E 2-E7	12	TD	Gulf Refining Co.	481	C	3186	42	....									
19-F8	464	....	Gulf Refining Co.	501	C	3011	42	....									
24-D2	430	....	Bell Bros.	493	C	3185	42	....	975	−482	3	1044	−451	4	542	−49	9
32-E1	2	....	Wiser Oil Co.	432	C	2992	41	....									
35-D7	3	....	Duncan, Inc.	446	C	3110	41	....									
1N 6E 10-D2	301	PT	Harding, R. O.	499	C	3312	39	2	1100	−601	10						
12-H1	302	....	Benedum Trees Oil Co.	479	C	3314	37	....							662	−183	8
21-A4	303	....	Gulf Refining Co.	510	C	3255	41	....									
21-B4	446	....	Gulf Refining Co.	512	C	3276	42	....							615	−103	11
21-E5	304	....	Jablonski	509	C	3300	41	....	1075	−566	..	1141	−632	..	640	−131	5
22-A2	305	....	Shell Oil Co., Inc.	488	C	3219	41	....	1053	−565	..	1122	−634	..	598	−110	8
22-A6	306	....	Shell Oil Co., Inc.	486	C	3191	41	....	1031	−545	4	1099	−613	..	583	−97	9
22-A7	307	....	Shell Oil Co., Inc.	493	C	3200	41	....	1044	−551	..	1114	−621	..	592	−99	9
22-D4	518	....	Texas Co.	472	C	3213	41	....							600	−128	10
22-E2	516	....	Texas Co.	478	C	3212	41	....							618	−140	8
22-E4	308	....	Pioneer Drilling and Howell	471	C	3187	41	....	1058	−587	4	1121	−650	5	614	−143	6
22-E6	517	....	Texas Co.	475	C	3290	41	....							624	−149	10
23-A5	311	....	Wiser Oil Co.	466	C	3192	41	....	1057	−591	..	1127	−661	..	596	−130	10
23-A7	310	....	Paul Miller	486	C	3199	41	....	1083	−597	..	1152	−666	..	616	−130	10
23-B8	312	....	Wiser Oil Co.	482	C	3202	42	....	1068	−586	..	1140	−658	..	611	−129	11
23-D5	309	....	O'Meara	470	C	3257	41	....	1080	−610	..	1146	−676	..	620	−150	8
26-A6	316	....	Ohio Oil Co.	447	C	3151	41	....	1025	−578	4	1096	−649	4	568	−121	8
26-C3	514	....	Texas Co.	453	C	3173	41	....							565	−112	7
26-E2	314	....	Deep Oil Co.	446	C	3189	41	....	1026	−580	..	1087	−641	..	570	−124	10
26-E5	515	....	Texas Co.	473	C	3174	41	....							594	−121	8
26-E8	318	....	Curtis Oil Co.	488	C	3133	41	2	1047	−559	4	1117	−629	4	594	−106	7
26-F4	317	....	Illinois Prod. Corp.	469	C	3187	41	....	1053	−584	3	1123	−654	3	595	−126	10
26-G7	315	....	United Prod. Co., Inc.	486	C	3162	41	....	1051	−565	4	1120	−634	4	594	−108	10
27-A2	*324	....	United Prod. and Urban	462	C	3082	41	....	1005	−543	4	1074	−612	4	565	−103	7
27-A5	*319	....	Wiser Oil Co.	462	C	3082	41	....	985	−523	4	1057	−595	5	533	− 71	10
27-B5	*320	....	Wiser Oil Co.	466	C	3069	41	....	986	−520	..	1052	−586	..	534	− 68	10
27-B7	*329	....	Shell Oil Co.	480	C	3065	41	....							543	− 63	8
27-C2	*327	....	United Producing Co.	477	C	3100	41	....							570	− 93	9

27–C3	*323	....	United Producing Co.	486	C	3072	41	....	1013	−527	4	1080	−594	4	564	− 78	8
27–C7	*321	....	Texas Co.	462	C	3032	41	....	985	−523	3	1052	−590	4	530	− 68	10
27–E1	*328	....	Wiser Oil Co.	490	C	3124	41	....							578	− 88	12
27–E3	*322	....	Carter Oil Co.	489	C	3075	41	....	1013	−524	3	1080	−591	4	566	− 77	8
27–E6	509	....	Texas Co.	482	C	3094	41	....							550	− 68	10
27–F1	*325	....	Wiser Oil Co.	494	C	3123	41	....							586	− 92	10
27–G7	510	....	Texas Co.	499	C	3160	41	....							580	− 81	10
27–H1	326	....	Wiser Oil Co.	497	C	3174	41	....	1054	−557	4	1125	−628	4	600	−103	12
28–A3	*333	....	Shell Oil Co.	509	C	3225	41	....	1038	−529	4	1104	−595	4	582	− 73	11
28–A5	*334	....	Gulf Refining Co.	505	C	3257	41	....	1033	−528	4	1103	−598	3	586	− 81	8
28–B5	*335	....	Gulf Refining Co.	514	C	3259	41	....	1044	−530	..	1112	−598	3	595	− 81	9
28–E1	*330	....	Yingling Bros.	518	C	3152	41	....							600	− 82	10
28–E2	513	....	Texas Co.	494	C	3121	41	....							575	− 81	10
28–E4	331	....	First National Pet. Trust	518	C	3178	41	....	1046	−528	4	1117	−599	3	597	− 79	8
28–F6	512	....	Texas Co.	516	C	3235	41	....							610	− 94	10
28–F7	465	....	Gulf Refining Co.	517	C	3280	42	....							620	−103	10
28–G5	332	....	Ohio Fuel Supply Co.	518	C	3201	41	....							615	− 97	7
33–A5	*466	....	Gulf Refining Co.	492	C	3266	41	....							575	− 83	10
33–B1	*348	....	Shell Oil Co.	472	C	3222	41	....							550	− 78	10
33–B2	*458	....	Gulf Refining Co.	478	C	3220	41	....							552	− 74	10
33–B3	*449	....	Gulf Refining Co.	487	C	3236	41	....							567	− 80	9
33–B4	*344	....	Shell Oil Co.	490	C	3240	41	....	1020	−530	4	1094	−604	4	566	− 76	12
33–C2	*347	....	Shell Oil Co.	484	C	3204	41	....							562	− 78	8
33–C3	*338	....	Wiser Oil Co.	489	C	3217	41	....							564	− 75	10
33–C5	*339	....	Wiser Oil Co.	501	C	4272	41	....	1047	−546	5	1120	−619	4	590	− 89	9
33–D2	*346	....	Shell Oil Co.	483	C	3200	41	....							562	− 79	8
33–D3	*341	....	Wiser Oil Co.	499	C	3222	41	....	1032	−533	4	1100	−601	4	570	− 71	9
33–E2	*345	....	Shell Oil Co.	485	C	3206	41	....							560	− 75	14
33–E3	*340	....	Wiser Oil Co.	496	C	3216	41	....							576	− 80	11
33–F2	*477	....	Gulf Refining Co.	480	C	3150	41	....							558	− 78	11
33–F5	*337	....	United Producing Co.	510	C	3284	41	....							595	− 85	9
33–G1	*343	....	Shell Oil Co.	460	C	3107	41	....	978	−518	4	1049	−589	4	534	− 74	9
33–H1	*342	....	Shell Oil Co.	485	C	3115	41	....							556	− 71	8
33–H3	*336	....	United Producing Co.	502	C	3192	41	....	1030	−528	4	1100	−598	4	578	− 76	9
33–H6	*476	....	United Producing Co.	599	C	3216	41	....							578	− 79	8
34–A1	*354	....	Wiser Oil Co.	456	C	3216	41	....							554	− 98	8
34–A5	*353	....	Wiser Oil Co.	472	C	3256	41	....	994	−522	4	1075	−603	4	551	− 79	8
34–A7	*459	....	Gulf Refining Co.	472	C	3026	42	....							546	− 74	8
34–A7	*355	....	Gulf Refining Co.	469	C	3215	41	....	998	−529	4	1079	−610	4	550	− 81	8
34–B3	*352	....	Wiser Oil Co.	466	C	3249	41	....							564	− 98	8
34–B5	*351	....	Wiser Oil Co.	477	C	3211	41	....	999	−522	4	1080	−603	4	550	− 73	8
34–C5	*350	....	Wiser Oil Co.	471	C	3250	41	....							543	− 72	8
34–E3	*349	....	United Producing Co.	467	C	3150	41	....							531	− 64	7

[a] County number in *italics* indicates hole logged by Survey field party.

Location	County number[a]	Type of hole	Operator	Surface elev., ft.	Datum sea-level How determined	Total depth, ft.	Year drilled	Doubtful information	Coal No. 6			Coal No. 5			"Shoal Creek" Limestone		
T., R., sec.									Depth, ft.	Altitude, ft.	Thickness, ft.	Depth, ft.	Altitude, ft.	Thickness, ft.	Depth, ft.	Altitude, ft.	Thickness, ft.
Wayne County—(Continued)																	
34–F1	*356	....	United Producing Co.	457	C	3125	41	....	1000	−543	4	1076	−619	4	547	− 90	8
34–F3	*360	....	United Producing Co.	464	C	3114	41	....							542	− 78	9
34–F5	*361	....	Wiser Oil Co.	445	C	3086	41	....							516	− 71	8
34–F7	*357	....	Illinois Producing Co.	472	C	3117	41	....							561	− 89	8
34–G1	*363	....	Wiser Oil Co.	460	C	3001	41	....							564	−104	12
34–G1	*362	....	Wiser Oil Co.	466	C	3119	41	....	1016	−550	4	1090	−624	4	558	− 92	10
34–G6	*364	....	Texas Co.	467	C	3068	41	....							530	− 63	10
34–G7	*359	....	Shell Oil Co.	452	C	3082	41	....							510	− 58	12
34–H7	*358	....	Shell Oil Co., Inc.	463	C	3073	41	....	972	−509	4	1042	−579	4	523	− 60	10
35–B7	372	....	United Producing Co.	436	C	3190	41	2				1074	−638	4	530	− 94	10
35–C3	369	....	Olson Oil Co.	447	C	3380	41	....							546	− 99	6
35–C7	368	....	United Producing Co.	435	C	3230	41	....							534	− 99	8
35–E4	373	....	United Producing Co.	467	C	3224	41	....	1010	−543	3	1094	−627	4	564	− 97	8
35–E5	367	....	Ruwaldt and Reeves	435	C	3153	41	....							545	−110	9
35–E7	371	....	United Producing Co.	462	C	3237	41	....							564	−102	8
35–F5	366	....	Ruwaldt and Reeves	437	C	3137	41	....							551	−114	7
35–G3	365	....	Jablonski	460	C	3170	41	....							569	−109	9
35–H3	375	....	Ohio Oil Co.	440	C	3145	41	....							553	−113	7
35–H5	370	....	Deep Oil Co.	438	C	3144	41	....							550	−112	13
36–A2	*384	....	United Producing Co.	513	C	3305	41	....							576	− 63	10
36–A4	*381	....	Shell Oil Co.	512	C	3268	41	....							565	− 53	6
36–A5	*392	....	Wiser Oil Co.	504	C	3276	41	....							567	− 63	10
36–A6	*393	....	Wiser Oil Co.	513	C	3327	41	....							579	− 66	9
36–A6	*387	....	National Pet. Co.	513	C	3290	41	....							574	− 66	9
36–A7	*390	....	Olson Oil Co.	497	C	3389	42	....							572	− 75	9
36–B3	*385	....	Olson Drilling Co.	520	C	3388	41	....							578	− 58	9
36–C1	*383	....	Deep Rock Oil Co.	501	C	3325	41	....							577	− 76	7
36–C2	*382	....	Deep Rock Oil Co.	511	C	3252	41	....							572	− 61	6
36–C3	*380	....	Shell Oil Co.	520	C	3277	41	....							578	− 58	8
36–C4	*379	....	Olson Drilling Co.	520	C	3240	41	....							580	− 60	7
36–C6	*391	....	Wiser Oil Co.	485	C	3261	41	....							548	− 63	9
36–D5	*388	....	Olson Oil Co.	500	C	3248	41	....							565	− 65	8
36–D8	389	....	Olson Drilling Co.	486	C	3289	41	2	1000	−514	..	1078	−592	..	555	− 69	9
36–E2	*386	....	Wiser Oil Co.	507	C	3261	41	2	990	−483	..	....	....	*0	563	− 56	6

		36–E4	*378	....	Wiser Oil Co.	511	C	3288	41	....							572	– 61	7
		36–E6	*394	....	Olson Oil Co.	504	C	3293	42	....							570	– 66	6
		36–F3	*377	....	Shell Oil Co.	515	C	3269	41	....							568	– 53	8
		36–H4	376	....	Olson Oil Co.	509	C	3328	41	....							576	– 67	10
1N	7E	1–C6	76	....	Pure Oil Co.	405	C	3034	40	....	926	–521	4	990	–585	5	525	–120	10
		2–B6	*443*[a]	....	Pure Oil Co.	444	C	2968	42	....	980	–536	4	1046	–602	5	....	....	....
		2–H1	77	....	Pure Oil Co.	408	G	3085	41	....	936	–528	4	1003	–595	3	524	–116	3
		2–H5	93	....	Sanders	439	C	3082	40	....	986	–547	..	1042	–603	..	556	–117	6
		4–E8	88	....	Bauer, J. E.	454	C	3241	41	....	1074	–620	4	1137	–683	5	646	–192	6
		11–G6	411	....	Pure Oil Co.	437	C	3090	..	....	972	–535	3	1040	–603	3	558	–121	9
		11–H7	479	....	Pure Oil Co.	448	C	3264	42	....	....	....	....	....	....	....	....	....	....
		12–A8	78	....	Pure Oil Co.	452	C	3127	41	....	1015	–563	..	1078	–626	4	582	–130	8
		17–H1	396	....	Shell Oil Co.	472	G	3240	42	....	1052	–589	5	1117	–645	4	612	–140	9
		18–F1	274	....	Hays, et al	471	C	3290	42	....	1062	–591	4	1130	–659	4	614	–143	6
		22–D4	96	....	Pure Oil Co.	445	C	3146	38	....	....	....	....	....	....	....	568	–123	8
		22–F2	431	....	Pure Oil Co.	451	C	3161	39	....	1000	–549	..	1065	–614	4	571	–120	7
		23–D8	79	....	Pure Oil Co.	459	C	3167	39	....	....	....	....	....	....	....	584	–125	8
		26–E8	*159	....	Pure Oil Co.	429	C	2970	37	....	....	....	....	....	....	....	525	– 96	12
		27–A6	80	....	Pure Oil Co.	441	G	3166	39	....	....	....	....	....	....	....	557	–116	8
		27–E1	89	....	Pure Oil Co.	446	C	7207	40	....	....	....	....	....	....	....	....	....	....
		27–E1	*95	....	Pure Oil Co.	452	H	3495	37	....	....	....	....	....	....	....	540	– 88	14
		27–H3	81	....	Pure Oil Co.	428	C	3100	38	....	....	....	....	....	....	....	530	–102	7
		31–D8	90	....	Aetna Oil Co.	489	C	3242	41	....	996	–507	..	....	....	*0	572	– 83	8
		31–E5	97	....	Sun Oil Co.	489	C	3289	41	....	992	–503	3	1066	–577	3	561	– 72	7
		34–A2	82	....	Pure Oil Co.	478	G	3300	38	....	994	–516	..	1065	–587	..	575	– 97	10
1N	8E	4–F4	83	....	Pure Oil Co.	461	C	3090	39	....	1017	–556	3	1085	–624	4	597	–136	8
		5–D4	84	....	Pure Oil Co.	442	C	3140	40	....	1023	–581	4	1098	–656	4	608	–166	7
		7–H1	85	....	Pure Oil Co.	422	C	3105	40	....	1007	–585	3	1070	–648	3	590	–168	7
		9–H6	86	....	Pure Oil Co.	435	C	3111	40	....	1003	–568	5	1068	–633	4	580	–145	5
		10–H7	87	....	Pure Oil Co.	443	C	3140	39	....	....	....	....	....	....	....	604	–161	6
		14–F8	400	....	Pure Oil Co.	418	G	3080	42	....	1008	–590	3	1080	–662	4	579	–161	4
		26–D5	275	....	Pure Oil Co.	414	C	3117	42	2	983	–569	4	1060	–646	4	554	–140	8
		34–F5	*98*	....	Hupp, et al	391	C	3281	42	....	950	–559	4	1022	–631	4	514	–123	8
		35–A4	92	....	Duncan and Jablonski	389	C	3096	42	....	931	–542	3	989	–600	3	492	–103	8
		35–A7	99	....	Muhlbach	390	C	3128	39	....	....	....	....	....	....	....	475	– 85	10
		35–C3	412	....	Pure Oil Co.	390	C	3125	..	....	923	–533	4	984	–594	4	493	–103	8
		35–C8	91	....	Pure Oil Co.	388	C	3112	42	....	904	–516	3	968	–580	3	472	– 84	8
		36–A8	413	....	Pure Oil Co.	425	C	3198	..	....	981	–556	4	1043	–618	3	545	–120	10
1N	9E	11–D8	100	....	Kingwood Oil Co.	399	C	3456	39	....	944	–545	..	1034	–635	..	500	–101	5
2N	5E	21–B5	*4	....	Benedum Trees Oil Co.	586	C	3313	37	....	....	....	....	....	....	....	670	– 84	10
		31–F3	429	....	Carter, et al	526	C	3145	42	2	1018	–492	3	1082	–556	4	630	–104	9

[a] County number in *italics* indicates hole logged by Survey field party.

Location T., R., sec.	County number[a]	Type of hole	Operator	Surface elev., ft.	Datum sea-level How determined	Total depth, ft.	Year drilled	Doubtful information	Coal No. 6 Depth, ft.	Coal No. 6 Altitude, ft.	Coal No. 6 Thickness, ft.	Coal No. 5 Depth, ft.	Coal No. 5 Altitude, ft.	Coal No. 5 Thickness, ft.	"Shoal Creek" Limestone Depth, ft.	"Shoal Creek" Limestone Altitude, ft.	"Shoal Creek" Limestone Thickness, ft.
Wayne County—(Continued)																	
2N 6E 26–D5	529	....	Gulf Refining Co.	471	G	3240	43	....	1085	−614	6	1151	−680	4	.....		
2N 7E 21–E8	25	....	Thompson and Sanders	428	G	3194	39	....	.....			.....			618	−190	7
24–G4	64	....	Pure Oil Co.	438	G	3090	40	2	1005	−567	3	1058	−620	4	590	−152	5
24–G5†	524	....	Sanders, et al	.....		3070	41	....	993	.....	4	1056	.....	4			
25–F1	65	....	Pure Oil Co.	436	C	3092	40	....	995	−559	4	1062	−626	4	578	−142	7
26–A5	66	....	Pure Oil Co.	451	C	3159	42	....	1010	−559	4	1074	−623	4	592	−141	6
28–A8	14	....	Benedum Trees Oil Co.	446	C	3280	37	2	1078	−632	4	1145	−699	5	645	−199	6
33–C4	22	....	Benedum Trees Oil Co.	427	C	3272	37	2	1050	−623	4	1114	−687	2	618	−191	8
33–C7	21	....	Benedum Trees Oil Co.	451	B	3154	37	2	1079	−628	1						
35–A1	67	....	Pure Oil Co.	433	C	3100	40	....	943	−510	..	1008	−575	3	532	− 99	8
36–B2	23	....	Pure Oil Co.	442	G	3070	41	....	1020	−578	4	1083	−641	3	592	−150	7
36–D4	68	....	Pure Oil Co.	425	C	3075	41	....	968	−543	4	1037	−612	4	542	−117	7
36–E6	24	....	Horn and Faulkner Pet. Co.	435	G	3054	41	2b	946	−511	5	1110	−675	6	529	− 94	10
2N 8E 19–B2	26	....	Sanders, et al	451	C	3030	41	....	1020	−569	3	1082	−631	4	.....		
21–B2	*444*	....	Pure Oil Co.	454	C	3060	42	....	1025	−571	4	1086	−632	5	.....		
21–H1	69	....	Pure Oil Co.	461	C	3105	40	....	1037	−576	4	1102	−641	4	635	−174	8
21–H6	27	....	Carter Oil Co.	450	C	3048	38	....	1038	−588	4	1117	−657	3	625	−175	8
22–E5	28	....	Freeman Oil Co.	453	C	3129											
22–H6	70	....	Pure Oil Co.	466	C	3057	42	....	1042	−576	3	1106	−640	4	630	−164	8
25–D6	150	....	Wiser Oil Co.	427	C	3132	39	....	995	−568	5	1066	−639	5	588	−161	8
26–D5	7	....	Siegel, I. W.	460	T	3087	41	....	1004	−544	3	1074	−614	4	604	−144	6
28–A3	71	....	Pure Oil Co.	466	C	3105	41	....	1025	−559	4	1094	−628	4	606	−140	8
29–A7	30	....	Sanders, et al	426	C	3052	41	....	1014	−588	3	1076	−650	4	594	−168	8
29–C7	29	....	Sanders	450	C	3069	41	....	1032	−582	4	1094	−644	4	610	−160	8
30–A2	*72	....	Pure Oil Co.	419	C	3040	41	....	1006	−587	4	1073	−654	3	587	−168	7
30–A3	*31	....	Sanders, et al	431	C	3037	41	....	1018	−587	3	1086	−655	4	603	−172	7
30–A4	*32	....	Sanders, et al	430	T	3057	41	....	1018	−588	4	1078	−648	4	598	−168	8
30–D3	*33	....	Sanders, et al	435	T	3073	41	....	1023	−588	4	1090	−655	4	610	−175	7
30–D4	*34	....	Sanders, et al	435	T	3051	41	....	1016	−581	3	1082	−647	4	606	−173	6
31–H3	*38	....	Sanders, et al	416	C	3025	41	....	.....			.....			574	−158	8
31–H3	*35	....	Sanders, et al	436	C	3041	41	....	1025	−589	4	1090	−654	4	604	−168	8
31–H4	*37	....	Sanders, et al	421	C	3029	41	....	.....			.....			573	−152	7

		31–H5	*36	....	Sanders, et al	435	G	3062	41	....	1020	−585	4	1076	−641	4	597	−162	8
		31–H6	*73	....	Pure Oil Co.	436	C	3050	41	....	1013	−577	4	1075	−639	4	588	−152	8
		32–D1	74	....	Pure Oil Co.	442	C	3085	40	....	1002	−560	4	1078	−636	3	603	−161	5
		33–C4	75	....	Pure Oil Co.	452	G	3075	39	....	1000	−548	..	1067	−615	..	605	−153	6
2N	9E	22–H5	39	....	Jarvis Bros. and Marcell	443	C	3300	40	....	998	−555	3	1069	−626	4	561	−118	7
1S	5E	1–E5	*408*	....	Gulf Refining Co.	488	G	3278	42	....	1011	−523	5	1084	−596	3	601	−113	9
		9–C1	20	....	Williams, B. F.	423	C	3154	42	....	....	....	....	....	....	....	520	− 97	12
		11–F5	275	....	Gulf Refining Co. and Helmerick and Payne	478	C	3259	42	....	1033	−555	4	1104	−626	4	600	−122	10
		17–A8	276	....	Central Pipe Line Co.	494	C	3086	42	....	....	....	*0	1046	−552	4	524	− 30	10
		17–C8	11	....	Armstrong and Day	....	....	2956	42	....	....	....	....	....	....	....	....	....	....
		17–E8	277	....	Webster	460	C	3028	42	....	....	....	*0	1030	−570	4	512	− 52	12
		18–A4	426	....	First National Pet. Co.	535	C	2969	42	....	....	....	*0	1072	−537	3	540	− 5	12
		18–C2	461	....	Gulf Refining Co.	513	C	2967	42	....	....	....	....	....	....	....	....	....	....
		18–C4	427	....	First National Pet. Trust	556	C	2982	42	....	....	....	*0	....	....	*0	567	− 11	11
		18–E3	6	....	First National Pet. Trust	556	C	3180	42	....	....	....	....	....	....	....	....	....	....
		18–E7	428	....	Bell Bros. and Brinkerhoff Drilling Co.	499	C	3100	42	....	....	....	*0	1020	−521	5	492	7	11
		18–F2	460	....	Gulf Refining Co.	480	C	2920	42	....	....	....	....	....	....	....	....	....	....
		18–F6	450	....	Gulf Refining Co.	502	C	2955	42	....	....	....	....	....	....	....	....	....	....
		18–G3	*462*	....	Gulf Refining Co.	478	C	2918	42	....	....	....	*0	1031	−553	3	520	− 42	10
		19–A4	425	....	McBride, Inc.	490	C	2888	42	....	928	−438	4	990	−500	4	486	4	11
		19–B2	480	....	Delk Investment Co.	508	C	2913	43	....	....	....	....	....	....	....	....	....	....
		19–C3	414	....	McBride, W. C.	512	C	2924	42	....	....	....	*0	1018	−506	4	500	12	18
		19–C5	526	....	McBride, W. C.	485	C	3068	42	....	....	....	....	....	....	....	....	....	....
		19–E5	527	....	Gulf Refining Co.	493	C	2874	42	....	....	....	....	....	....	....	....	....	....
		19–F2	10	....	Gulf Refining Co.	500	C	2925	42	....	....	....	....	....	....	....	....	....	....
		19–G2	463	....	Gulf Refining Co.	485	C	2920	42	....	....	....	....	....	....	....	....	....	....
		19–G3	9	....	Gulf Refining Co.	512	C	2916	42	....	....	....	....	....	....	....	....	....	....
		24–D3	439	....	Dickerson	420	G	3240	41	....	....	....	....	....	....	....	....	....	....
		24–D4	19	....	Blake, Brickson and Brown	420	G	....	41	....	....	....	....	....	....	....	....	....	....
		29–D6	17	....	Robinson, C.	460	G	3085	40	....	....	....	....	....	....	....	....	....	....
		30–H1	18	....	Gulf Refining Co.	471	G	3250	38	....	....	....	....	....	....	....	....	....	....
		30–H4	7	....	McBride, Inc.	474	C	3056	42	....	....	....	....	....	....	....	....	....	....
1S	6E	1–D4	40	....	Deep Rock Oil Corp.	486	C	3218	41	....	1036	−550	..	1106	−620	..	580	− 94	10
		1–D6	453	....	Gulf Refining Co.	493	C	3286	42	....	....	....	....	....	....	....	572	− 79	8
		1–E2	* 41	....	Olson Oil Co.	494	C	3266	41	....	....	....	....	....	....	....	594	−100	10
		1–F1	* 42	....	Olson Oil Co.	485	C	3336	41	....	1042	−557	..	1129	−644	..	606	−121	8
		1–F5	* 45	....	Olson Oil Co.	497	C	3255	41	....	1015	−518	4	1092	−595	4	567	− 70	8
		1–F7	* 46	....	Olson Oil Co.	489	C	3294	....	....	997	−508	4	1083	−594	4	558	− 69	9
		1–H2	* 44	....	Wiser Oil Co.	503	C	3318	41	....	....	....	....	....	....	....	583	− 80	8
		1–H3	* 43	....	Wiser Oil Co.	502	C	3284	41	....	1024	−522	..	1104	−602	..	582	− 80	10

[a] County number in *italics* indicates hole logged by Survey field party.
† Erroneously located in section 30 on maps.

Location	County number[a]	Type of hole	Operator	Surface elev., ft.	Datum sea-level How determined	Total depth, ft.	Year drilled	Doubtful information	Coal No. 6			Coal No. 5			"Shoal Creek" Limestone		
T., R., sec.									Depth, ft.	Altitude, ft.	Thickness, ft.	Depth, ft.	Altitude, ft.	Thickness, ft.	Depth, ft.	Altitude, ft.	Thickness, ft.
Wayne County—(Continued)																	
1–H4	* 48	....	Shell Oil Co.	501	C	3270	41	....	1016	−515	4	1096	−595	3	569	− 68	8
1–H5	* 47	....	Shell Oil Co., Inc.	502	C	3268	41	....							572	− 70	8
2–C4	* 49	....	White, Ivan	435	C	3274	41	....							568	−133	8
3–E7	*454	....	Gulf Refining Co.	446	C	1795	42	....							538	− 92	8
3–E8	*472	....	Gulf Refining Co.	458	C	3231	42	....							550	− 92	12
3–F4	* 51	....	Wiser Oil Co.	465	C	3220	42	....									
3–F5	*455	....	Gulf Refining Co.	455	C	3233	42	....							540	− 85	10
3–H4	* 50	....	Wiser Oil Co.	471	C	3246	41	....	1001	−530	3	1094	−623	3	556	− 85	8
3–H5	* 53	....	Olson Oil Co.	470	C	3233	41	....	1004	−534	4	1086	−616	4	556	− 86	8
3–H6	* 52	....	Olson Oil Co.	466	C	3218	41	....	996	−530	4	1075	−609	4	556	− 90	8
3–H8	*244	....	Carter Oil Co.	459	C	3223	41	....	992	−533	3	1075	−616	3	544	− 85	7
4–C6	*144	....	Eason Oil Co. and Obering	476	C	3279	42	....	1036	−560	4	1107	−631	4	570	− 94	8
4–E3	*143	....	Ohio Fuel Supply Co.	476	C	3227	42	....	1028	−552	4	1104	−628	3	574	− 98	8
4–F2	*508	....	Texas Co.	457	C	3182	41	....							552	− 95	10
4–H1	* 54	....	Carter Oil Co.	464	C	3225	41	....	1005	−541	3	1082	−618	3	554	− 90	8
4–H6	*403	....	Mid-Continent Pet.	481	G	3224	42	....							576	− 95	7
5–E1	55	....	Hudson-Hess Drilling Co.	481	C	3320	41	....	1044	−563	5	1114	−633	3	576	− 95	10
10–B1	56	PT	Ohio and Indiana Oil Co.	422	B	1496	....	2	968	−654	6	1045	−623	10			
10–B2	8	....	Lessing, Alch	446	C	3300	39	....	984	−538	3	1073	−627	4	530	− 84	13
14–H1	* 57	....	Duncan, Inc.	463	C	3266	42	....							540	− 77	10
17–A1	145	....	Kingwood Oil Co.	443	C	3241	42	....	985	−542	4	1060	−617	4	520	− 77	10
17–D5	114	....	Pure Oil Co.	455	C	3250	42	....	999	−544	5	1075	−620	4	537	− 82	9
20–A4	519	....	Texas Co.	446	C	3195	42	....							500	− 54	10
20–E3	415	....	Carter Oil Co.	446	C	3215	42	....	976	−530	3	1050	−604	4	510	− 64	11
20–G5	276	....	Pure Oil Co.	452	C	3175	42	2	986	−534	4	1060	−608	4	526	− 74	12
20–G7	473	....	Pure Oil Co.	460	C	3177	42	....							536	− 76	10
20–H4	395	....	Duncan and Taylor	447	C	3200	42	....	986	−539	4				520	− 73	10
21–A8	277	....	Duncan, Inc.	448	C	3196	42	....	940	−492	4	1020	−572	4	487	− 39	9
21–C6	58	....	Russell, et al.	450	C	3488	40	....	950	−500	..	1032	−582	4	493	− 43	9
21–H5	59	....	O'Shaughnessy	427	C	3230	42	....	957	−530	5	1043	−616	3	497	− 70	10
22–B8	507	....	Texas Co.	455	C	3218	42	....							490	− 35	10
22–F6	60	....	Armer, M. B.	447	C	3227	42	....	976	−529	4	1057	−610	4	510	− 63	8
24–A1	481	....	Deep Rock Oil Co.	447	C	3265	42	....							526	− 79	10
25–E3	113	....	Pure Oil Co.	441	C	3305	42	....							502	− 61	8

		26–H6	61		Frazier, C. F.	412	C	3247	42									472	– 60	8
		27–A2	63		Harrey Sims Drilling Co.	438	C	3250	42					*0	1026	–588	4	466	– 28	8
		27–E6	506		Texas Co.	458	C	3194	42									502	– 44	10
		27–F4	62		Duncan, et al	450	C	3220	42		967	–517	4	1046	–596	4		488	– 38	6
		27–G8	504		Texas Co.	460	C	3210	42									490	– 30	10
		28–B8	102		Bell Bros.	432	C	3185	41		925	–493	4	1004	–572	4		458	– 26	10
		28–C2	503		Texas Co.	457	C	3245	42									472	– 15	8
		28–E6	470		Gulf Refining Co.	446	C	3169	42									468	– 22	4
		28–E8	467		Gulf Refinlng Co.	438	C	3179	42									464	– 26	10
		28–F1	104		Swan-King Oil Co.	462	C	3215	41		946	–484	5	1025	–563	4		484	– 22	8
		28–F2	103		Swan-King Oil Co.	464	C	3219	41		942	–478	4	1022	–558	3		480	– 16	8
		28–F3	502		Texas Co.	464	C	3185	42									476	– 12	12
		28–G5	106		Fotiades	448	C	3229	42		923	–475	5	998	–550	4		470	– 22	8
		28–H8	105		Duncan, Inc.	449	C	3189	42		942	–493	4	1016	–567	4		480	– 31	8
		29–B1	500		Texas Co.	426	C	3175	42									452	– 26	12
		29–F5	499		Texas Co.	436	C	3172	42									484	– 48	12
		29–G2	501		Texas Co.	443	C	3194	42									478	– 35	10
		29–H3	107		Duncan, Inc.	443	C	3192	42		939	–496	4	1015	–572	4		480	– 37	8
		30–E4	108		Buerkle, C.	443	C	3272	41									530	– 87	10
		32–C8	*398*		Gulf Refining Co.	432	G	3230	42				*0	1042	–610	3		478	– 46	10
		32–D2	456		Gulf Refining Co.	428	C	3217	42											
		33–B6	447		Gulf Refining Co.	438	C	3242	42									470	– 32	10
		33–C6	448		Gulf Refining Co.	434	C	3200	42											
		33–C7	452		Gulf Refining Co.	419	C	3195	42											
		33–E4	498		Texas Co.	440	C	3172	42									454	– 14	10
		33–F6	451		Gulf Refining Co.	438	C	3192	41									470	– 32	8
		33–F7	110		Bell Bros.	430	C	3044	41											
		33–G4	457		Gulf Refining Co.	453	C	3170	42											
		33–H2	111		Bell Bros.	453	C	3175	42				*0	1015	–562	4		463	– 10	10
		33–H6	109		Bell Bros.	442	C	3170	41	2	940	–498	..	1016	–574	4		467	– 25	10
		33–H7	488		Bell Bros.	440	C	3037	42									468	– 28	12
		34–D8	432		Hudson, J. H.	451	C	3255	42				*0					499	– 48	6
		34–G8	497		Texas Co.	463	C	3211	42									466	– 3	8
		36–G2	112		Sohio Prod. Co.	434	C	3256	42				*0	1046	–612	3		506	– 72	8
1S	7E	3–F5	118		Pure Oil Co.	492	C	3212	42	2			*0	1079	–587	4		582	– 90	10
		8–D5	433		Duncan, Inc.	487	C	3310	42		1070	–583	3	1157	–670	3		627	–140	10
		9–D7	416		Duncan, Inc.	475	C	3250	42		1045	–570	3	1128	–653	4		595	–120	10
		9–E8	*115		Thompson, V.	476	C	3320	42									600	–124	8
		9–G8	278		Duncan, Inc.	477	C	3243	42		1040	–563	4	1115	–638	3		606	–129	9
		10–C8	489		Echols, Geo.	455	C	3303	43											
		11–B3	280		Schulte and Wix	423	G	3095	42		992	–569	4	1090	–667	3		540	–117	8
		11–D3	279		Schulte and Wix	426	G	3104	42	2	998	–572	4	1096	–670	3		545	–119	10
		11–E2	482		Pure Oil Co.	429	C	3145	42											

[a] County number in *italics* indicates hole logged by Survey field party.

Location T., R., sec.			County number[a]	Type of hole	Operator	Surface elev., ft.	Datum sea-level How determined	Total depth, ft.	Year drilled	Doubtful information	Coal No. 6 Depth, ft.	Coal No. 6 Altitude, ft.	Coal No. 6 Thickness, ft.	Coal No. 5 Depth, ft.	Coal No. 5 Altitude, ft.	Coal No. 5 Thickness, ft.	"Shoal Creek" Limestone Depth, ft.	"Shoal Creek" Limestone Altitude, ft.	"Shoal Creek" Limestone Thickness, ft.
Wayne County—(Continued)																			
		17–B2	469	....	Gulf Refining Co.	401	C	3380	42	....							524	−123	10
		19–D3	294	....	Craft, C. R.	402	C	3330	42	....	944	−542	..	1020	−618	..			
		23–D7	245	....	Carter Oil Co.	393	C	3399	42	....	994	−601	4	1071	−678	4	500	−107	8
		25–A2	163	PT		370	T	1538	....	2	994	−624	9						
		28–H1	*193	....	Whitty, et al	393	G	3400	39	....							512	−119	14
		29–D3	*164	....	Reward Oil Co., et al	393	C	3219	42	....							468	− 75	7
		30–E7	165	....	Rennick	429	C	3431	41	....	1005	−576	4	1082	−653	4	512	− 83	9
		31–H6	166	....	Washburn Pet. Co.	404	C	3418	38	....	985	−581	6	1064	−660	5	497	− 93	10
2S	7E	1 E6	167	....	Gulf Refining Co.	448	C	3333	41	....	1050	−602	4	1128	−680	5	596	−148	9
		1 H4	168	....	Gulf Refining Co.	473	C	3346	41	2	1078	−605	..	1158	−685	4	624	−151	18
		1 H6	169	....	Gulf Refining Co.	454	C	3327	41	....	1035	−581	3	1116	−662	4	592	−138	10
		2 C5	*435*	....	Gulf Refining Co.	424	C	3300	42	....				1064	−640	4			
		2–E2	153	....	Ohio Fuel Supply Co.	440	C	3324	42	....	....	.....	*0	1075	−635	4	544	−104	8
		2–F3	170	....	Watkins Drilling Co. and Weinert	430	C	3297	42	....	....	.....	*0	1072	−642	4	516	− 86	14
		2–G1	152	....	Watkins Drilling Co. and Weinert	452	C	3314	41	....	....	.....	*0	1085	−633	5	558	−106	19
		2–H4	151	....	Diamond Half Oil Co.	435	C	3338	40	....	....	.....	*0	1061	−626	4	534	− 99	8
		3–D5	172	....	Weinert, Inc.	416	C	3270	39	2	995	−539	..	1030	−614	5	489	− 73	9
		3–D7	171	....	Roche and Voyles	431	C	3245	40	....	978	−547	3	1048	−617	4	503	− 72	8
		3–G8	173	....	Oil Well Drilling Co.	435	C	3263	39	....	983	−548	3	1058	−623	4	525	− 90	8
		4–A1	176	....	Texas Co.	421	G	3256	39	....	967	−546	3	1040	−619	4	505	− 84	7
		4–A7	*436	....	Black Panther Oil Co.	453	C	3322	40	....							550	− 97	10
		4–A8	*295	....	Meyers Drilling Co.	451	C	3300	40	....	1020	−569	..	1096	−645	..			
		4–A8	*440	....	O'Meara	454	C	3327	40	....							555	−101	5
		4–B7	*177	....	D. P. Oil Co.	445	C	3295	40	....							548	−103	7
		4–C1	*180	....	Holschuh and Murphy	426	C	3110	41	....	978	−552	4	1048	−622	4	514	− 88	11
		4–C6	*154	....	Diamond Half Oil Co.	456	C	3290	40	....							568	−112	9
		4–D1	*156	....	Weinert, H. H.	426	G	3325	39	....	984	−558	3	1055	−629	4	518	− 92	10
		4–D6	*155	....	Meyers Drilling Co.	465	C	3284	40	....	1040	−575	..	1106	−641	..	560	− 95	10
		4–E1	*17	....	Roche and Voyles	450	T	3265	38	....	1012	−562	4	1086	−636	4	539	− 89	9
		4–E6	*174	....	D. P. Oil Co.	450	C	3293	40	....							560	−110	10
		4–F5	*175	....	D. P. Oil Co.	450	C	3293	40	....	1023	−573	4	1095	−645	5	555	−105	10
		4–G1	*179	....	Weinert, Inc.	449	G	3271	39	....	1012	−563	3	1085	−636	5	514	− 65	9
		9–F4	441	....	O'Meara	427	C	3298	40	....							500	− 73	10

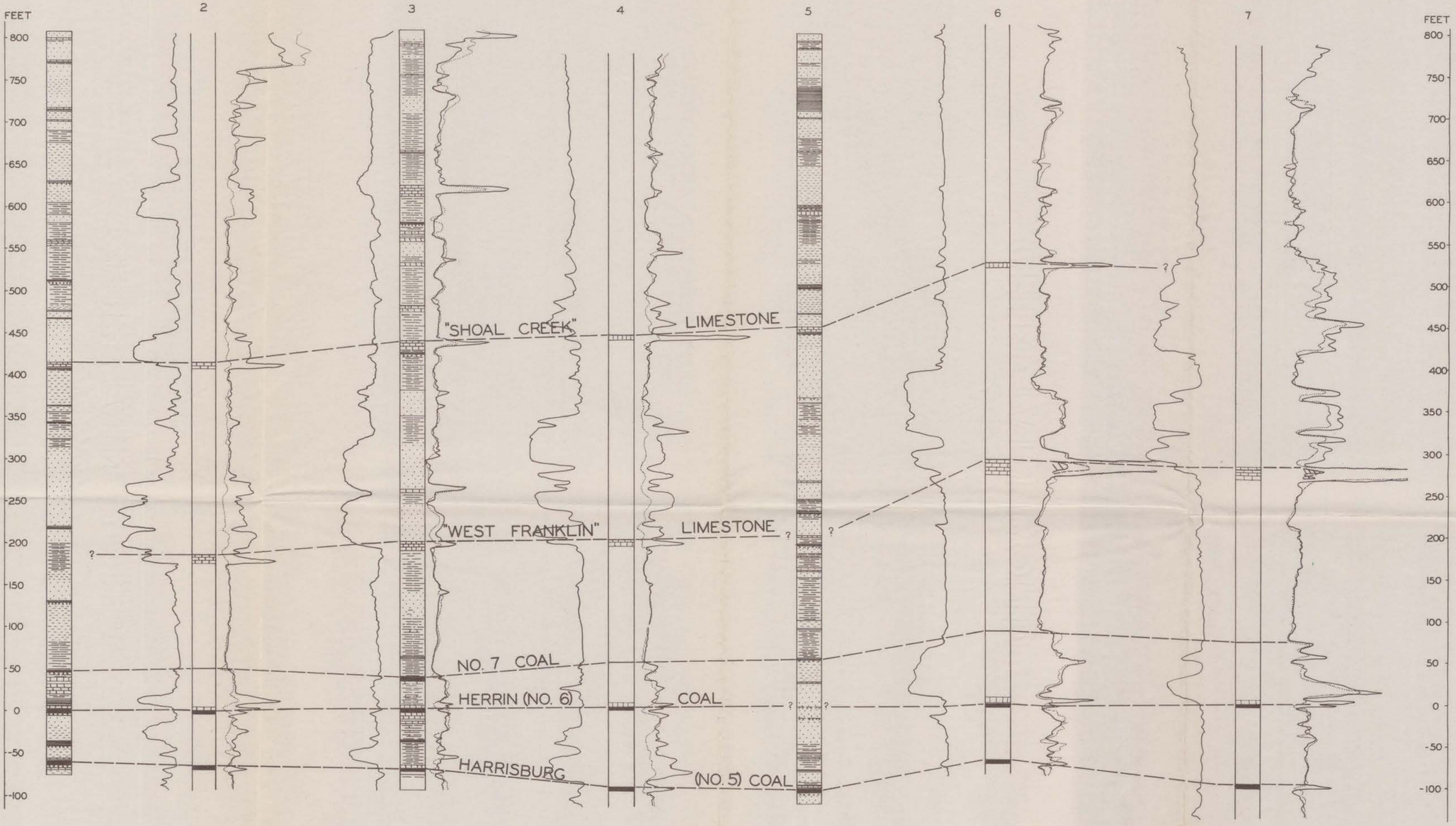
		9–G3	296		Weinert, Inc.	427	C	3270	40		974	−547	4	1047	−620	5	507	− 80	9
		9–H8	181		Texas Co.	449	G	3310	40		1025	−576		1094	−645	3	549	−100	9
		10–F8	157		Weinert, Inc.	410	C	3283	39		945	−535	3	1016	−606	5	475	− 65	8
		10–G8	495		Texas Co.	423	C	3315	40								500	− 77	6
		11–H1	183		Watkins Drilling Co. and Weinert	445	C	3330	42				*0	1104	−659	5	568	−123	8
		12–H7	182		Watkins Drilling Co. and Weinert	432	C	3320	42		1028	−596		1102	−670	4	572	−140	8
		28–A2	184		Pure Oil Co.	378	G	3428	38								457	− 79	13
		28–C2	185		Dome Oil and Gas Co.	381	C	3342	40	2	926	−545	3	1020	−639	4	454	− 73	13
		29–E3	486		Keck, et al	404	G	3409	39								495	− 91	10
		32–C1	186		Rock Hill Oil Co.	381	C	3343	38				*0	1000	−619	5	435	− 54	12
		32–C4	*189		Rock Hill Oil Co.	380	G	3408	39								458	− 78	12
		33–B4	188		Texas Co.	380	G	3355	40		948	−568	4	1030	−650	3	443	− 60	7
		33–C2	*401*		Texas Co.	380	G		42		959	−579	5	1035	−655	3			
		33–C8	187		Rock Hill Oil Co.	382	C	5370	40	2b	916	−534	3	1094	−712	4	430	− 48	10
		33–D3	*191		Texas Co.	381	G	3440	38								465	− 84	12
		33–E3	158		Weinert, H. H.	383	C	3335	39		930	−547	5	1015	−632	5	460	− 77	7
		33–G7	*190		Texas Co.	384	G	3340	38								430	− 46	20
2S	8E	2–D4	194		Schuller, Lynch, et al	451	C	3491	42	2	1042	−591				*0	542	− 91	8
		4–E4	*195*		Watkins Drilling Co. and Weinert	419	C	3323	42	2	1018	−599					529	−110	7
		9–E7	196		Martin, Ed.	397	C	3832	40		981	−584	4	1055	−658	4	500	−103	8
		14–F8	197		Robinson, C.	410	T	3364	39	2				1096	−686	4	512	−102	6
		17–A1	198		Robinson Puckett, Inc.	454	C	3410	41		1028	−574	5	1104	−650	4	520	− 66	5
		17–D6	297		Robinson Puckett, Inc.	481	C	3390	42		1094	−613	5	1150	−669	4	568	− 87	6
		19–F8	199		Nation, B. H.	480	G	3464	41		1093	−613	5	1167	−687	5	604	−124	8
		19–H6	*221		Ben Nation Oil Co.	498	C	3490	41	2	1095	−597	5						
		24–E8	200		South State Dev. Corp.	410	C	3434	39	2			*0	1087	−677	4	492	− 82	5
		25–D3	201		Robinson, C.	382	C	3452	41		964	−582	5	1043	−661	3	450	− 68	5
		26–A3	204		Robinson Puckett, Inc.	448	C	3432	41	2	973	−525		1080	−632		485	− 37	4
		26–A4	202		Robinson, C.	454	C	3433	40				*0	1085	−631	4	494	− 40	5
		26–A7	203		Robinson, C.	428	C	3414	40	2b	986	−558	6	1003	−575	4	466	− 38	7
		26–B6	298		Wayne Development Co.	430	C	3409	40		994	−564	3	1054	−624	4	466	− 36	7
		26–C5	205		Robinson, C.	433	C	3420	40				*0	1060	−627		466	− 33	6
		27–E3	207		Illinois Mid-Continent Co.	410	G	3383	39		990	−580	5	1060	−650	3	462	− 52	6
		27–G4	206		Weinert, Inc.	422	G	3506	39		1016	−594	5	1085	−663	5	492	− 70	6
		34–D4	299		Dome Oil and Robinson	446	C	3878	40					1105	−659		479	− 33	7
		34–D5	213		Dunlap, O. T.	460	C	3445	39				*0	1105	−645	5	485	− 25	6
		34–E4	210		Dunlap, O. T.	425	T	3439	39		1013	−588		1084	−659	4	472	− 47	6
		34–E5	209		Robinson, C.	430	C	3415	40								465	− 35	8
		34–G4	211		Robinson, C.	416	C	3406	39								445	− 29	7
		34–H4	212		Robinson, C.	410	T	3396	40								438	− 28	6
		34–H5	208		Robinson, C.	445	T	3394	39		1008	−563		1080	−635	5	452	− 7	7
		35–B6	216		Gulf Refining Co.	405	T	3456	39				*0	1054	−649	4	437	− 32	5
		35–D1	215		Noble, A. S.	462	C	3462	39								509	− 47	6

[a] County number in *italics* indicates hole logged by Survey field party.

Location			County number[a]	Type of hole	Operator	Surface elev., ft.	Datum sea-level How determined	Total depth, ft.	Year drilled	Doubtful information	Coal No. 6			Coal No. 5			"Shoal Creek" Limestone		
T., R., sec.											Depth, ft.	Altitude, ft.	Thickness, ft.	Depth, ft.	Altitude, ft.	Thickness, ft.	Depth, ft.	Altitude, ft.	Thickness, ft.
Wayne County—(Concluded)																			
		35–F8	219	....	Illinois Mid-Continent Co.	461	C	3421	39	....	....	.....	*0	1101	−640	..	496	− 35	7
		35–G5	218	....	Snyder, Alex	446	C	3414	39	2	....	.....	*0	1090	−644	4	475	− 29	5
		35–G6	217	....	Snyder, Alex	454	C	3412	39	....	.....	.....	.....	1085	−631	5	484	− 30	6
		35–H7	214	....	Robinson, C.	441	G	3855	40	2	1000	−559	3	1077	−636	4	483	− 42	7
2S	9E	4–B6	*239*	....	Bell Bros.	387	C	3376	42	2b	....	.....	*0	1048	−661	2	...	.....	*0
		7–B7	223	....	New Penn. Dev. Corp.	409	C	5645	39	....	1006	−597	..	1085	−678	..	...	.....	*0
		7–D4	222	....	New Penn. Dev. Corp.	428	G	3437	39	....	.....	.....	.....	.....	.....	.....	...	.....	*0
		7–E2	220	....	New Penn. Dev. Corp.	430	T	3425	39	....	.....	.....	.....	.....	.....	.....	...	.....	*0
		15–B5	*225	....	Porter, R. D.	382	G	3381	39	....	.....	.....	.....	.....	.....	.....	...	.....	*0
		18–C4	226	....	New Penn. Dev. Corp.	468	C	3507	41	....	1050	−582	3	1136	−668	4	...	.....	*0
		21–D1	229	....	New Penn. Dev. Corp.	389	C	3410	42	....	915	−526	3	1012	−623	4	...	.....	*0
		21–G7	*227	....	New Penn. Dev. Corp.	383	G	3374	39	2	965	−582	8	.....	.....	.....	...	.....	*0
		24–B1	230	....	Tide Water Assoc. Oil	450	C	3365	41	2b	940	−490	..	1060	−610	..	...	.....	*0
		24–D8	231	....	Powell, John	443	G	3366	40	2	973	−530	..	1046	−603	..	...	.....	*0
		28–F2	233	....	New Penn. Dev. Corp.	386	C	3436	42	....	.....	.....	.....	1022	−636	..	...	.....	*0
		28–H4	234	....	New Penn. Dev. Corp.	387	C	3311	42	....	.....	.....	.....	.....	.....	.....	...	.....	*0
		28–H6	232	....	New Penn. Dev. Corp.	372	G	3395	42	....	....	.....	4	1012	−640	4	...	.....	*0
		29–C3	*528*	....	New Penn. Dev. Corp.	386	C	....	43	....	925	−539	5	.....	.....	.....	...	.....	*0
		30–A3	235	....	New Penn. Dev. Corp.	385	C	3373	41	2b	909	−524	3	1014	−629	4	416	− 31	8
		30–C2	236	....	Chevigny, J.	409	C	3386	41	2	942	−533	..	1050	−641	3	...	.....	*0
		30–C3	237	....	New Penn. Dev. Corp.	386	C	3364	41	2b	924	−538	..	1026	−640	4	...	.....	*0
		31–H6	238	....	New Penn. Dev. Corp.	382	C	3373	41	2b	915	−533	..	1011	−629	3	408	− 26	6
3S	5E	7–G1	402	....	Lario Oil and Gas Co.	496	C	3193	42	....	....	.....	3	....	.....	4	506	− 10	11
		15–F3	15	....	Witt	409	C	3432	41	....	1008	−599	4	1078	−669	6	486	− 77	12
3S	6E	5–C5	494	....	Texas Co.	448	C	3568	41	....	.....	.....	.....	.....	.....	.....	510	− 62	12
		7–B4	*246	....	Texas Co.	408	C	3375	42	....	.....	.....	.....	.....	.....	.....	485	− 77	10
		7–D4	491	....	Texas Co.	410	C	3360	42	....	.....	.....	.....	.....	.....	.....	465	− 55	10
		7–E1	492	....	Texas Co.	418	C	3347	41	....	.....	.....	.....	.....	.....	.....	476	− 58	14

		7–F4	247		Texas Co.	407	C	3348	42								470	− 63	10
		8–D4	442		Texas Co.	460	C	3477	42								520	− 60	8
		8–D7	493		Texas Co.			3469	41								495		10
		8–F8	*248*		Texas Co.	451	C	3395	42	2b	992	−541	4	1092	−641	6			
3S	7E	4–D5	475		Texas Co.	382	C	3443	42								434	− 52	10
		5–A1	254		Rock Hill Oil Co.	378	G	3365	38		930	−552	3	1019	−641	5	430	− 52	8
		5–B4	*255		Rock Hill Oil Co.	379	G	3346	39								458	− 79	14
		5–D1	*253		Rock Hill Oil Co.	379	G	3346	38								436	− 57	14
		5–D5	*249		Texas Co.	381	G	3502	39		970	−589	10				470	− 89	12
		5–E1	*251		Rock Hill Oil Co.	378	G	3342	38								430	− 52	16
		5–E5	422		Holland, K. D.	382	G	3354	38	2	961	−579	5	1064	−682	..			
		5–H1	250		Weinert, Inc.	379	G	3344	38	2	920	−541	4	1020	−641	5	435	− 56	10
		5–H3	*252		Rock Hill Oil Co.	379	G	3355	38								460	− 81	7
		8–B3	*256		Texas Co.	380	G	3355	40								423	− 43	5
		8–D1	257		Texas Co.	379	G	3360	40	2	912	−533	4	1015	−636	4	414	− 35	9
		9–A5	490		Texas Co.	380	C	3357	41								390	−10	10
		16–B5	259		Texas Co.	378	G	3335	38										
		16–F7	258		Texas Co.	378	G	3287	38										
		16–G5	*397*		Texas Co.	376	G	3340	42		901	−525	5						
3S	8E	2–D1	260		Illinois Mid-Continent Co.	462	C	3499	39	2	1044	−582	..	1125	−663	5	525	− 63	5
		3–F4	*261		Illinois Mid-Continent Co.	491	C	3519	42								530	− 39	5
		4–A1	437		M. I. O. U. Co.	461	C	3496	40								515	− 54	7
		4–F3	262		Ichenhauser and Brentano	459	C	3512	40								516	− 57	9
		6–E2	*300*		Watkins Drilling Co. and Weinert	444	C	3540	42	2	1076	−632	3				580	−136	10
		9–E1	263		Lain Oil and Gas Co.	410	C	3517	40								480	− 70	6
		17–H1	264		French, Lavender, et al.	446	C	3525	40										
3S	9E	1–E5	*438*		Cherry and Kidd	410	C	3451	42		926	−516	4						*0
		8–G7	265		Olson Drilling Co.	400	T	3418	38	2b	921	−521	4	1021	−621	5	482	− 82	10
		9–A5	269		Southern Petrol. Corp.	399	C	3408	39		924	−525	4	1022	−623	3			*0
		9–C7	267		Schlafly and Damvon Co.	413	G	3424	40	2	938	−525	4	1039	−626	5			*0
		9–F4	268		Southern Petrol. Corp.	386	C	3426	40	2b	914	−528	4	1016	−630	4			*0
		12–A1	270		Randall, H.	382	G	3426	40	2	897	−515	3	976	−594	5			*0
		16–D6	272		New Penn. Dev. Co.	392	C	3383	40	2b	922	−530	4	1024	−632	4			*0
		16–D7	271		Southern Petrol Co.	405	C	3416	40	2b	950	−545	4	1045	−640	3			*0

[a] County number in *italics* indicates hole logged by Survey field party.



LEGEND

SHALE
SANDSTONE
SILTSTONE
LIMESTONE
BLACK SHALE
COAL
UNDERCLAY

LEFT SIDE OF ELECTRICAL LOG SHOWS SELF-POTENTIAL IN MILLIVOLTS

1. PURE OIL CO.-L. PATTERSON NO. 1
2. J.W. SANDERS-L. HUBBLE NO. 1
3. W.E. HUPP-S. FARRIS NO. 1
4. PURE OIL CO-R.L. JOHNSON NO. A-2
5. GULF OIL CO-PAUL CARTER NO. 1
6. ILL. MID-CONTINENT CO-F WRIGHT NO. 1
7. SOUTHERN PET CORP-P WALKER NO. B-2

RIGHT SIDE OF ELECTRICAL LOG SHOWS RESISTIVITY IN OHMS
— NORMAL CURVE —THIRD CURVE

NORTH-SOUTH GRAPHIC SECTION OF WELLS IN WAYNE COUNTY

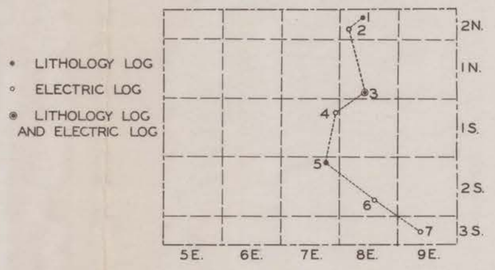
SHOWING

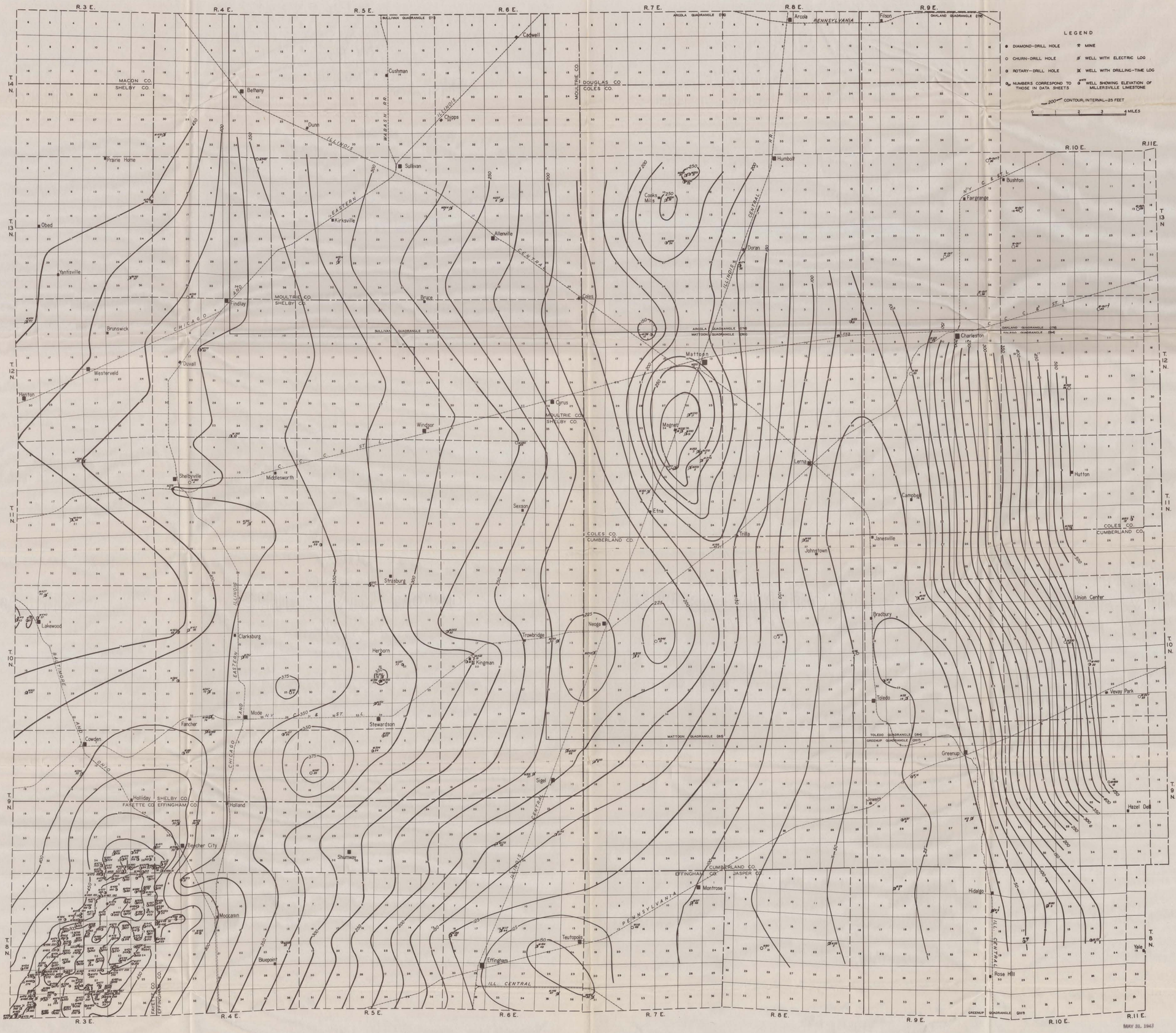
CORRELATION OF CERTAIN PENNSYLVANIA STRATA

BY

PAUL K. SIMS

WAYNE COUNTY INDEX MAP





STRUCTURE MAP OF THE MILLERSVILLE LIMESTONE

IN

CUMBERLAND COUNTY AND PARTS OF COLES, DOUGLAS, MOULTRIE, MACON, SHELBY, FAYETTE, EFFINGHAM, AND JASPER COUNTIES

BY

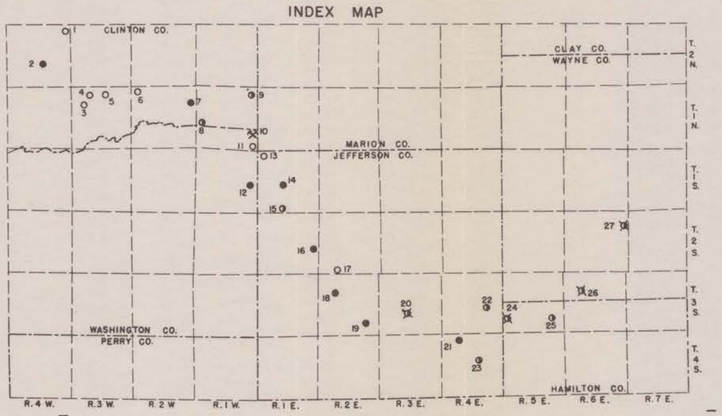
EARLE F. TAYLOR

ASSISTED BY A. L. EDDINGS

G. H. CADY, HEAD OF THE COAL DIVISION

MAY 31, 1943

INDEX MAP



LEGEND

- LIMESTONE
- BLACK "SLATE"
- DIAMOND-DRILL HOLE
- CHURN-DRILL HOLE
- COAL
- UNDERCLAY
- ROTARY-DRILL HOLE
- WELL LOGGED BY MEMBERS OF THE COAL DIVISION

1 BONFA-WESSEL ET AL.—HOSTMEIR NO. 1, SEC. 1, T. 2 N., R. 4 W.
2 FUTURE COAL & MINING CO., SEC. 22, T. 2 N., R. 4 W.
3 OHIO OIL CO.-P. KLEINEKARTE NO. 1, SEC. 8, T. 1 N., R. 3 W.
4 SANTE FE O. & G.-H. ROBBINS NO. 1, SEC. 5, T. 1 N., R. 3 W.
5 HEMPEN & BURGESS-F. ISAAK NO. 1, SEC. 3, T. 1 N., R. 3 W.
6 F. A. McNEIL-F. VOGEL NO. 1, SEC. 6, T. 1 N., R. 2 W.
7 GERMANTOWN FLOUR MILLS, SEC. 12, T. 1 N., R. 2 W.
8 TRIO OIL CO.-R. PAULSMEYER NO. 1, SEC. 19, T. 1 N., R. 1 W.
9 SHELL PET. CORP.-FELTON CRILEY NO. 1, SEC. 1, T. 1 N., R. 1 W.
10 CENTRALIA COAL CO. NO. 5 MINE, SEC. 25, T. 1 N., R. 1 W.
11 PETRO O. & G.-A. DODILLET NO. 1, SEC. 36, T. 1 N., R. 1 W.
12 CRAVAT COAL CO. NO. 3, SEC. 24, T. 1 S., R. 1 W.
13 ROLEUM O. & G.-M. HARDY NO. 1, SEC. 6, T. 1 S., R. 1 E.
14 CRAVAT COAL CO. NO. 1, SEC. 21, T. 1 S., R. 1 E.
15 CHERRY, KIDD & O'NEAL-GIORDANO NO. 1, SEC. 33, T. 1 S., R. 1 E.
16 A. R. BYRD & SONS NO. 1, SEC. 24, T. 2 S., R. 1 E.
17 SHILOH OIL CO.-CEBE MANNEN NO. 1, SEC. 32, T. 2 S., R. 2 E.
18 INLAND STEEL NO. 3, SEC. 8, T. 3 S., R. 2 E.
19 INLAND STEEL NO. 4, SEC. 26, T. 3 S., R. 2 E.
20 LEWIS PROD.-STATE NO. 1, SEC. 21, T. 3 S., R. 3 E.
21 MOORE'S PRAIRIE COAL ASS'N. NO. 1, SEC. 5, T. 4 S., R. 4 E.
22 UNION MINING CO.-BLACKWARD NO. 1, SEC. 23, T. 3 S., R. 4 E.
23 LEDBETTER-LOGAN NO. 1, SEC. 15, T. 4 S., R. 4 E.
24 SEABOARD-KIEFER NO. 1, SEC. 30, T. 3 S., R. 5 E.
25 SINCLAIR WYO.-ZELLERS NO. 1, SEC. 26, T. 3 S., R. 5 E.
26 TEXAS-BUTLER NO. 1, SEC. 8, T. 3 S., R. 6 E.
27 DEEP ROCK-ATKIN-WIND. COMM. NO. 1, SEC. 12, T. 2 S., R. 6 E.

"SHOAL CREEK" LIMESTONE

HERRIN (NO. 6) COAL

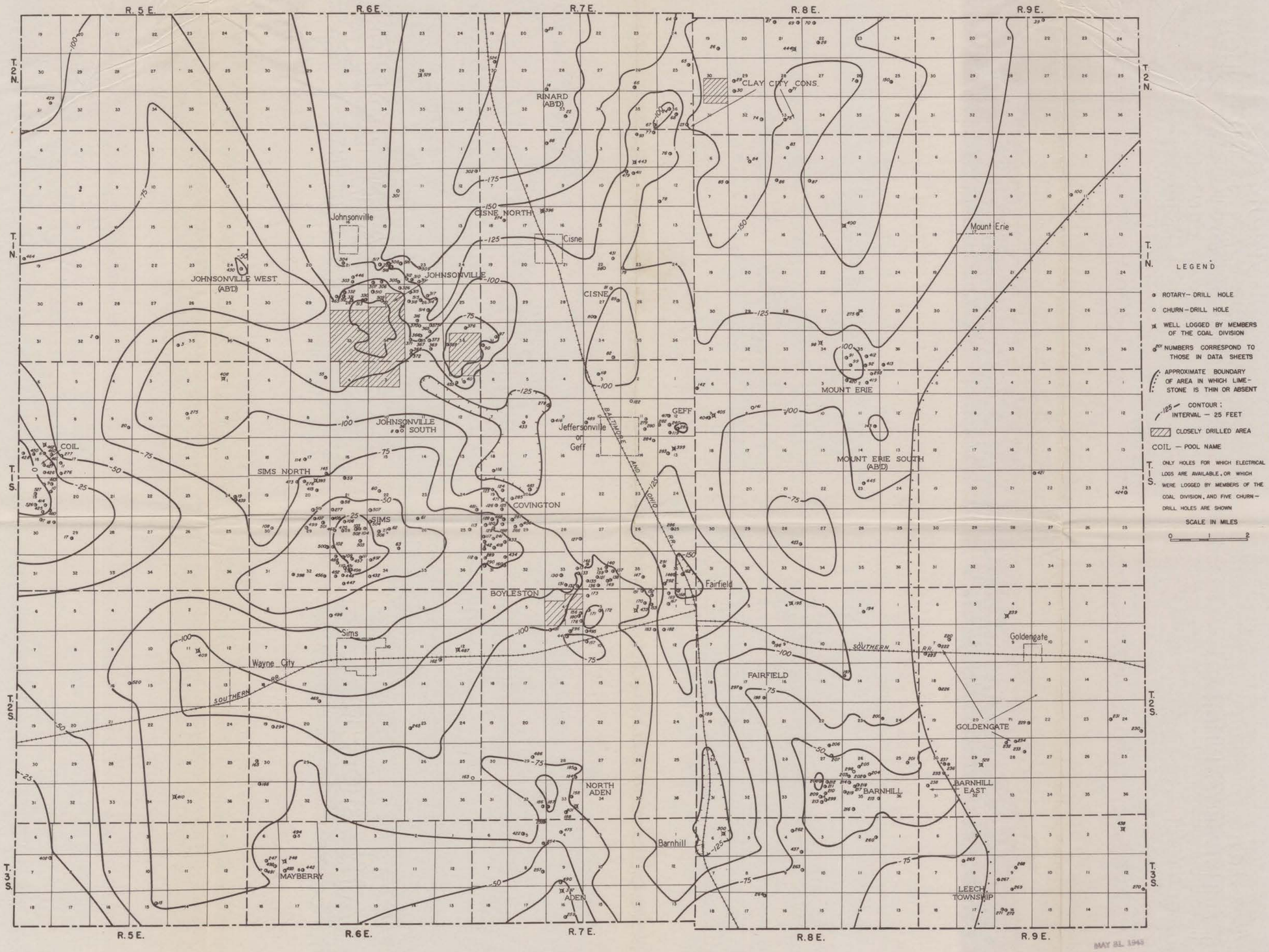
FEET: 900, 800, 700, 600, 500, 400, 300, 200, 100, 0, -100, -200, -300

DIAGRAM SHOWING

CORRELATION OF "SHOAL CREEK" LIMESTONE FROM CLINTON TO WAYNE COUNTIES

BY

PAUL K. SIMS



STRUCTURE MAP OF "SHOAL CREEK" LIMESTONE

IN

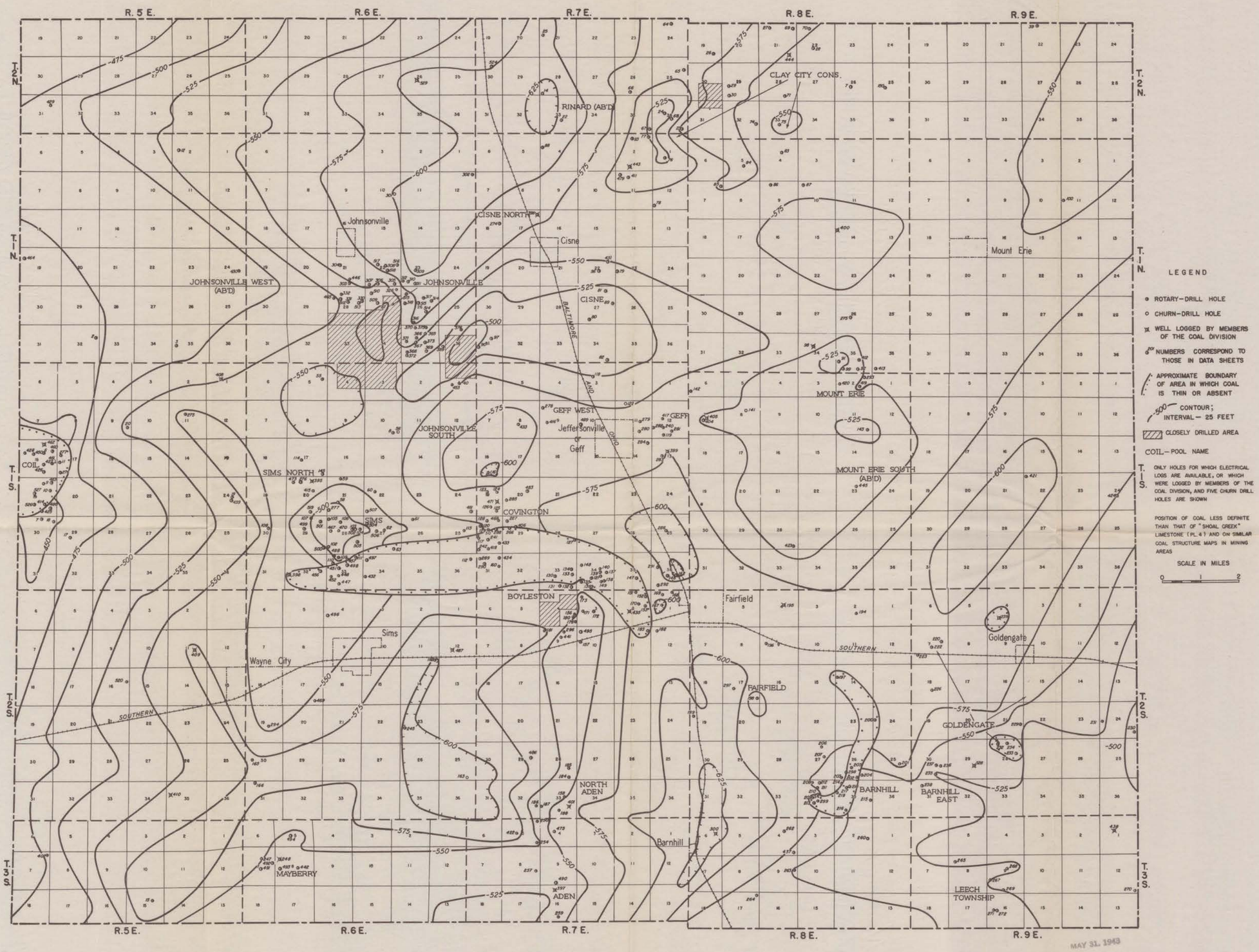
WAYNE COUNTY

BY

PAUL K. SIMS

ASSISTED BY J. N. PAYNE, A. L. EDDINGS, AND A. L. BROKAW

G. H. CADY, HEAD OF THE COAL DIVISION



TENTATIVE STRUCTURE MAP OF HERRIN (No. 6) COAL BED IN WAYNE COUNTY

BASED PRIMARILY ON ELECTRIC LOGS

BY

PAUL K. SIMS

ASSISTED BY R. C. SMITH, A. L. EDDINGS, AND J. N. PAYNE

G. H. CADY, HEAD OF THE COAL DIVISION